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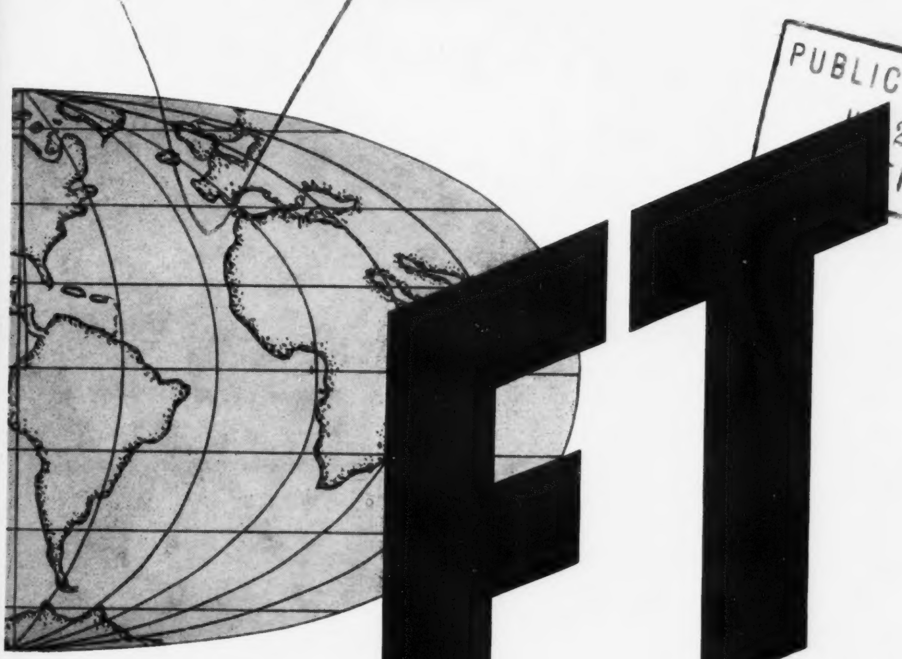
OUR 64th YEAR

A BILL BROTHERS PUBLICATION

JUNE, 1953



See Cabot Announcement Pages 294 - 295

CABOT

India RUBBER WORLD, June, 1953, Vol. 128, No. 3. Published monthly by BILL BROTHERS PUBLISHING CORP. Office of Publication, 1309 Noble Street, Philadelphia, Pa., with Editorial and Executive Offices at 386 Fourth Avenue, New York 16, N. Y., U.S.A. Entered as Second Class Matter at the Post Office at Philadelphia, Pa., under the act of March 3, 1879. Subscription United States and Mexico, $5.00 per year; Canada $6.00; All other Countries

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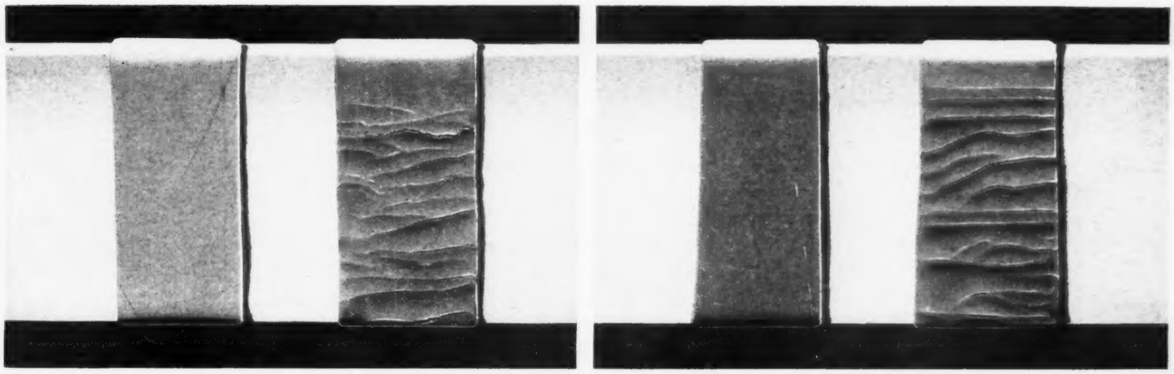

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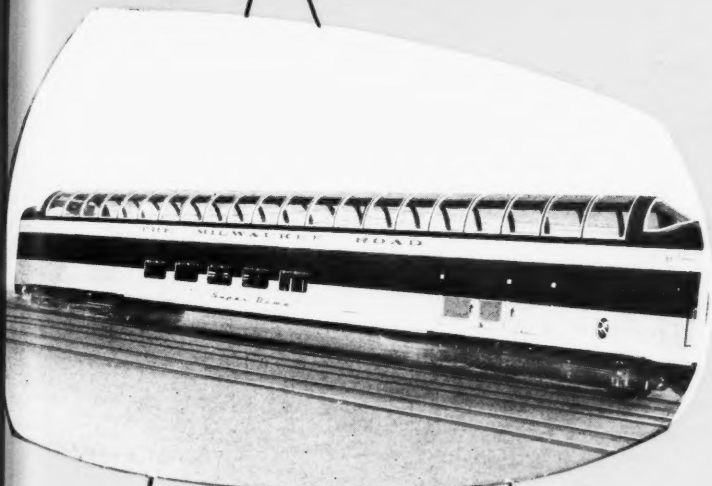

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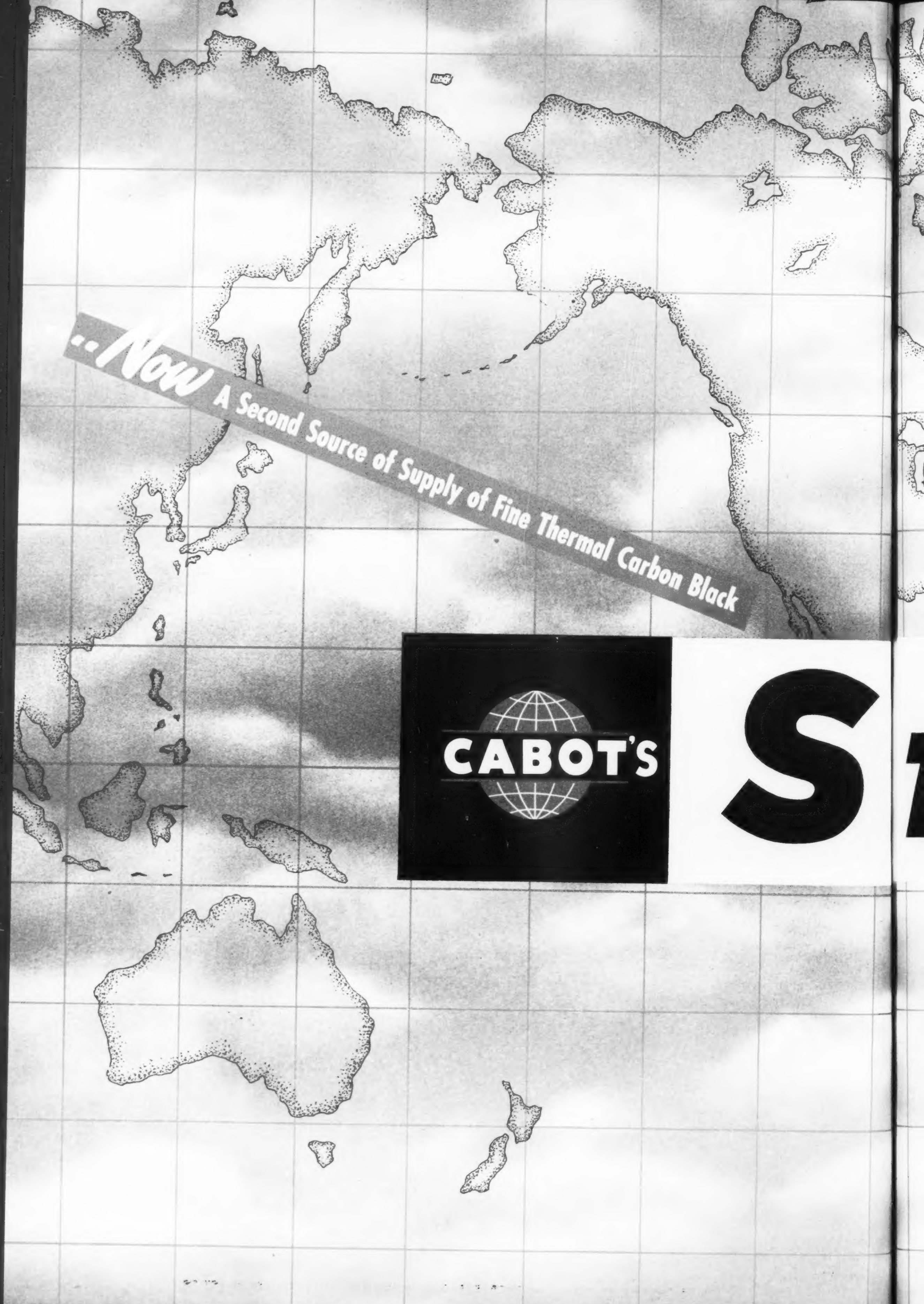

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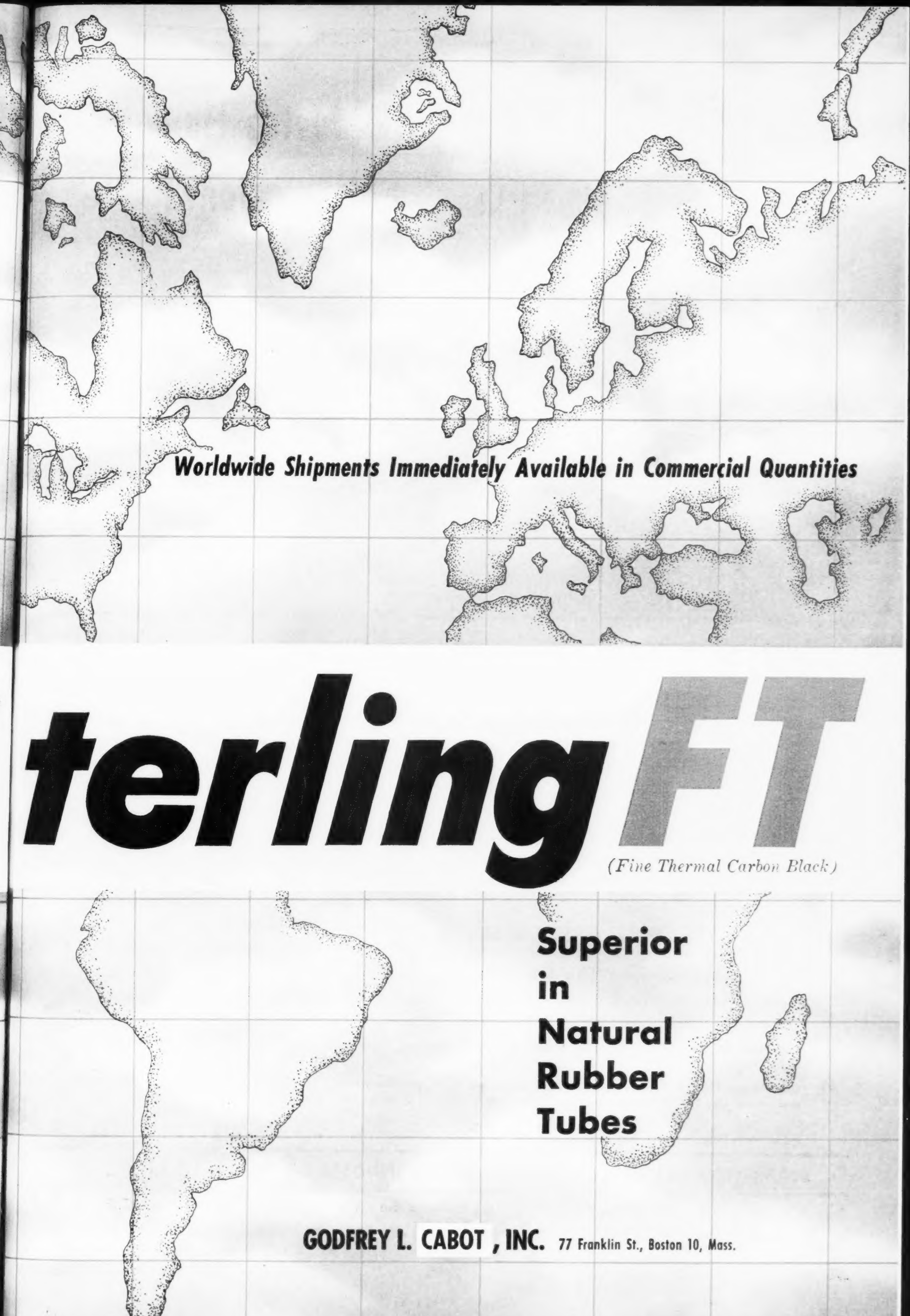
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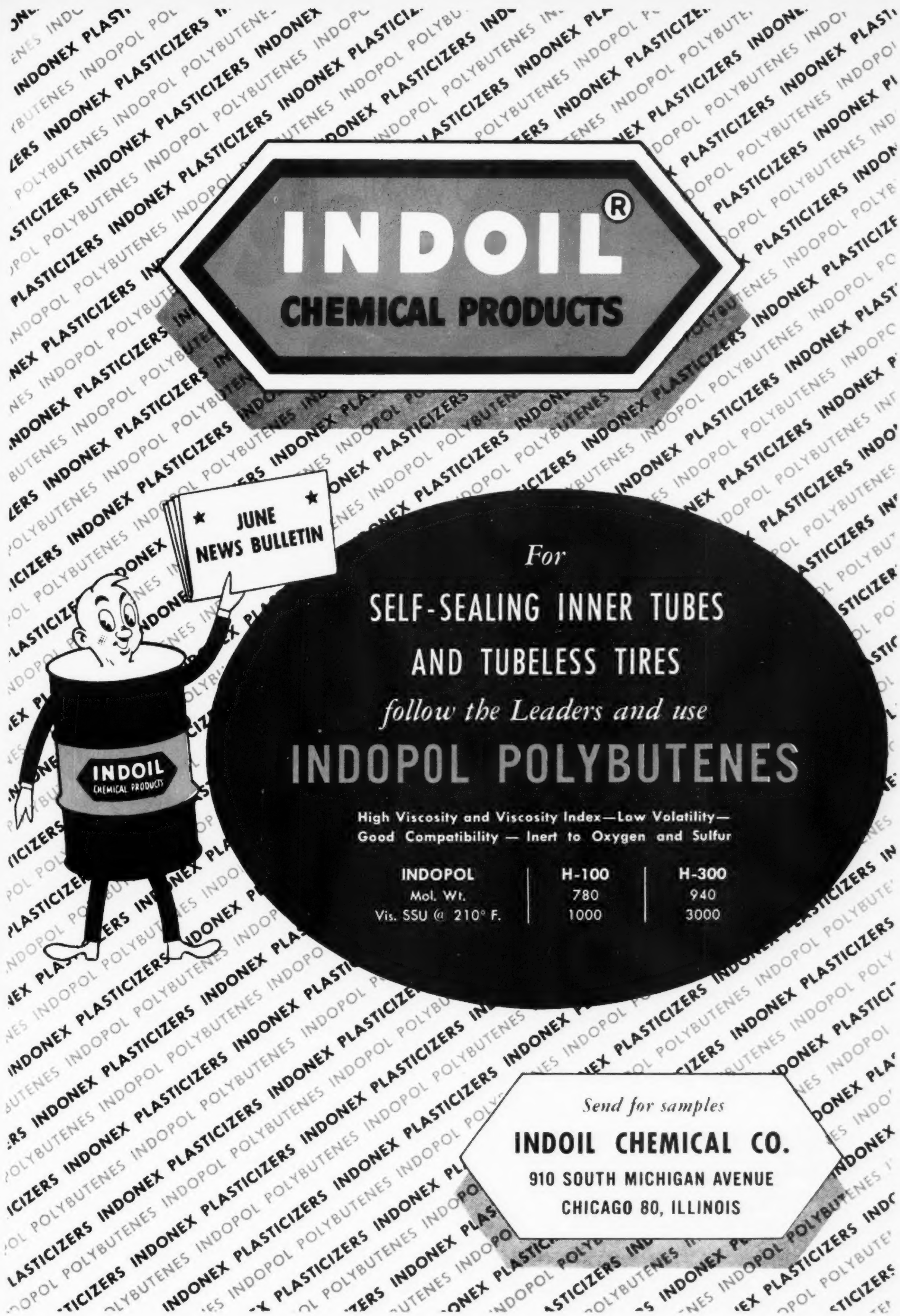
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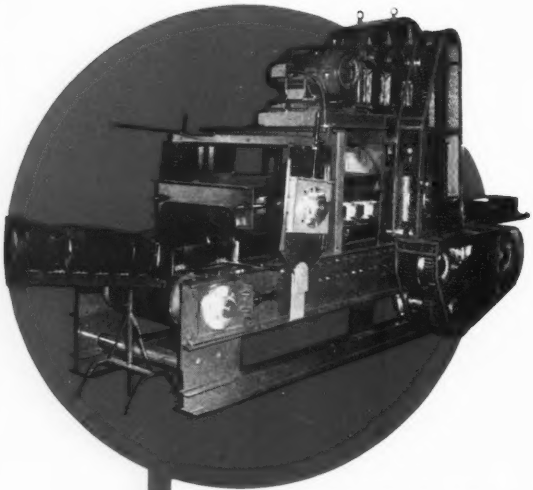

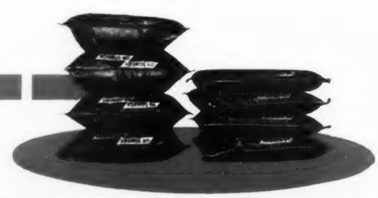

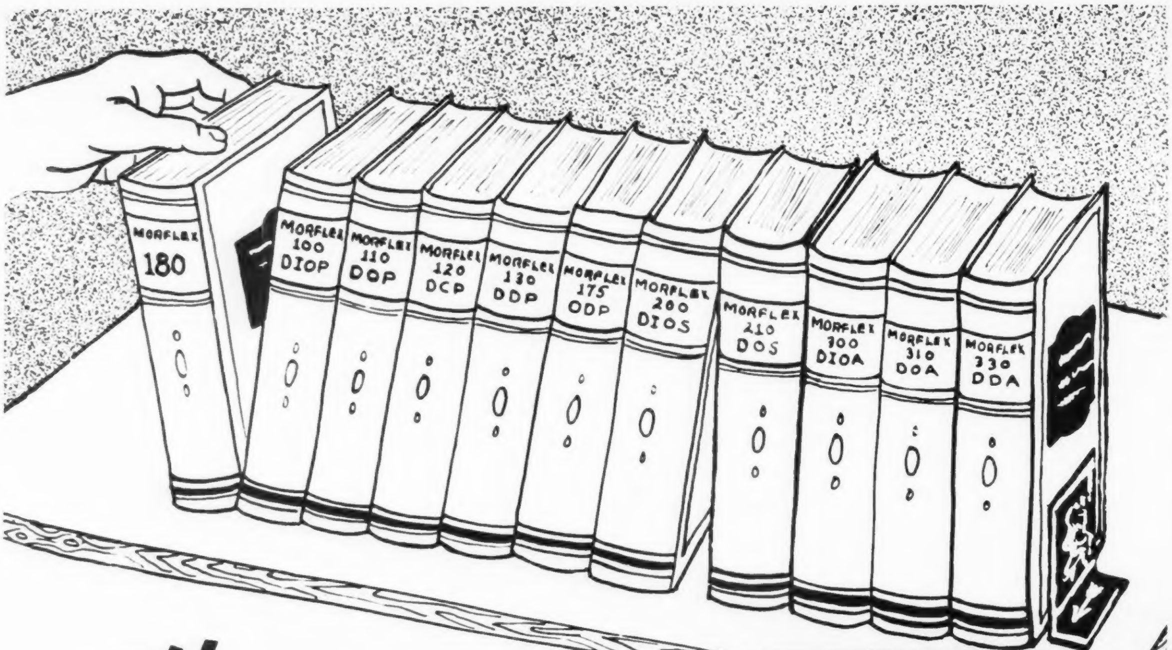

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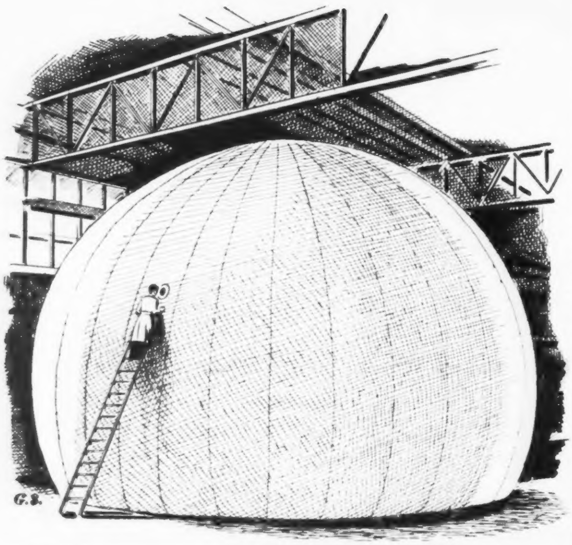
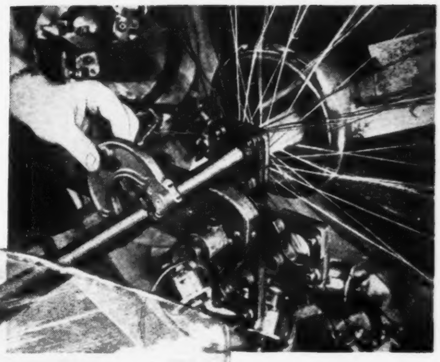
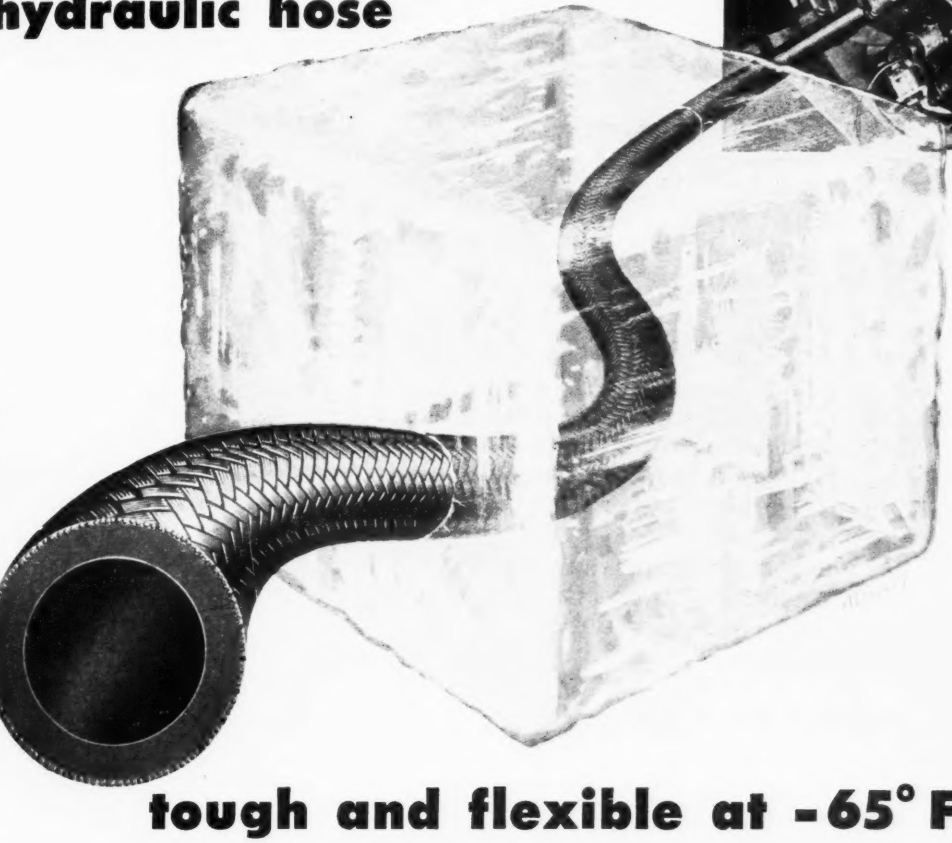


New *Paracril*® hydraulic hose





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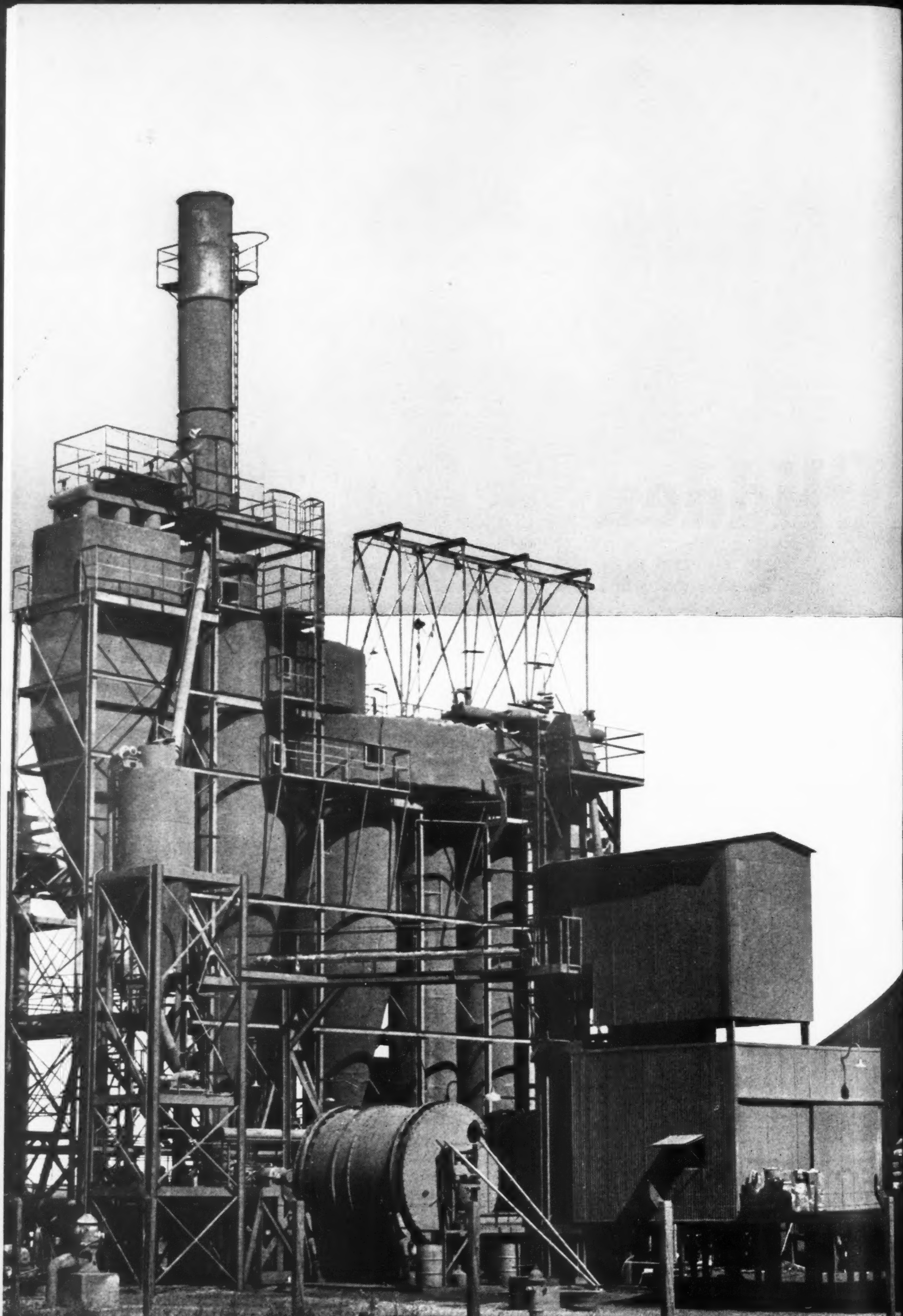

THE HISTORY OF THE RUBBER INDUSTRY—Number 3

how long did it take to get from here

to here?

Answer: Ten Years

Records indicate that rubber was first used in submarine cables in 1811, in the Isar River, near Munich, Germany. Similar cable was made by the Russians in 1812.

However, it was not until 1838, in England, that development work was begun on rubber insulation for electrical wires. By 1848, ten years later, vulcanization and an insulation compound had been developed, as well as a process for strip-covering wire with rubber. Thus, rubber insulation of electrical wiring was commercially practical. First production in the United States was started in 1868.

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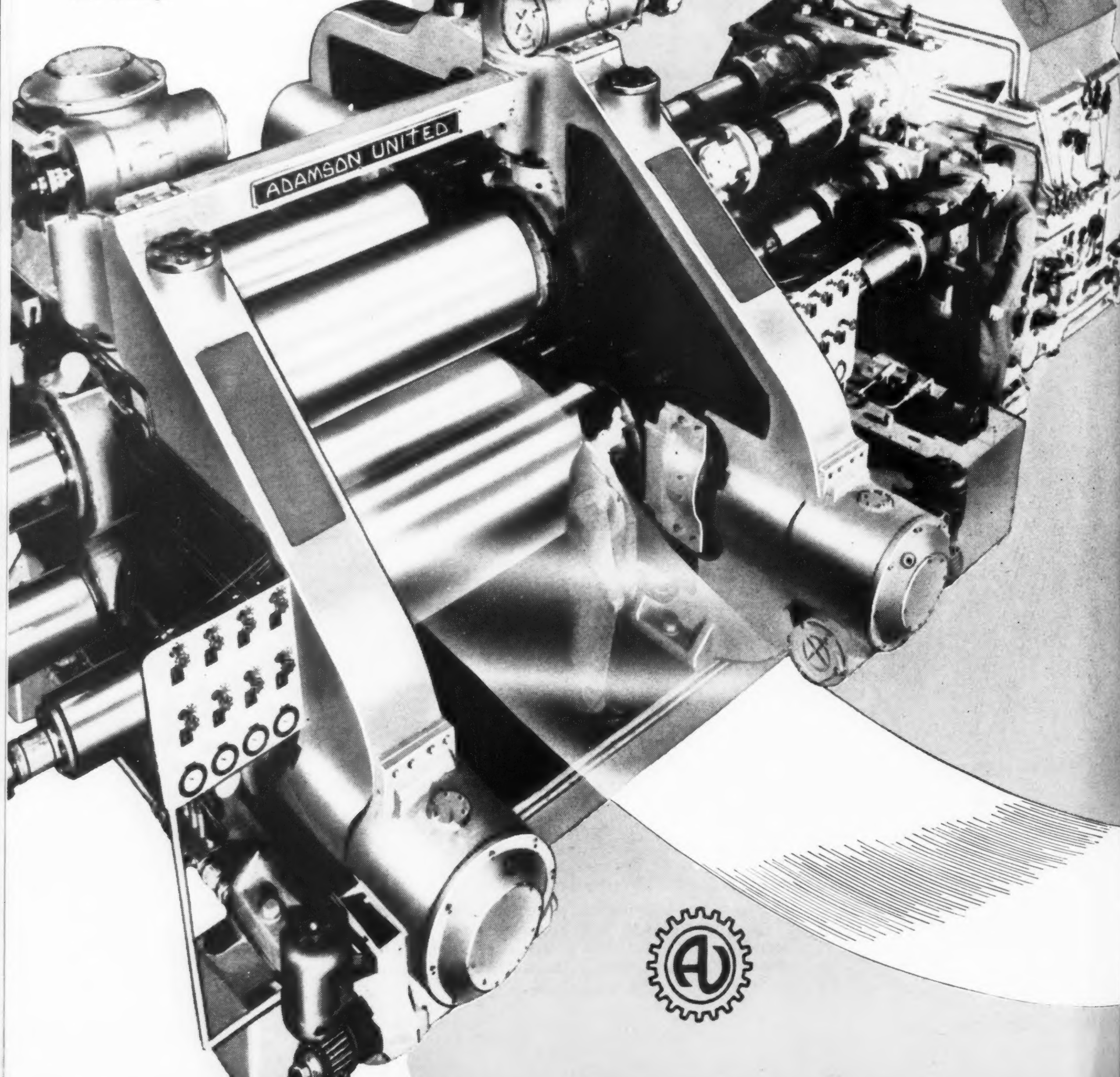
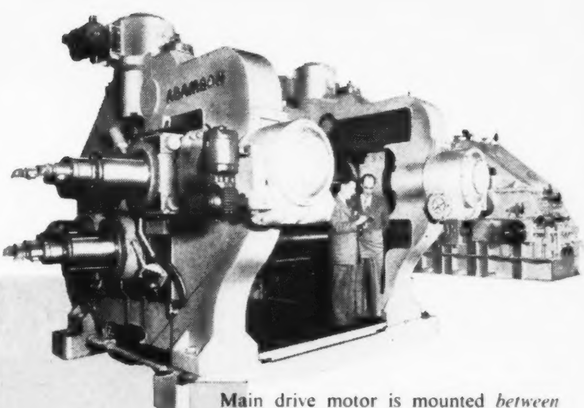


Zee-Type PRECISION CALENDER



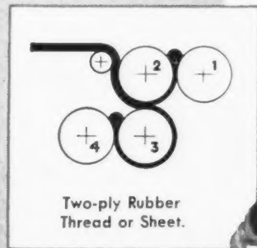
Main drive motor is mounted *between* the calender and pinion gear stand, reducing overall length significantly. Gage adjusting equipment is unitized construction, assuring positive alignment, with double enveloping worms and worm gears mounted in anti-friction bearings.

The new Adamson 4-roll calender is a completely modern Zee-type unit, especially designed for double-coating tire cord or producing two-ply laminated material. The improved features available on this unit greatly increase the accuracy of calendering operations, and assure a more uniform product with substantial savings in material. Higher production speeds can be obtained; and crown compensating equipment provides uniform transverse gage under varying conditions of operation.

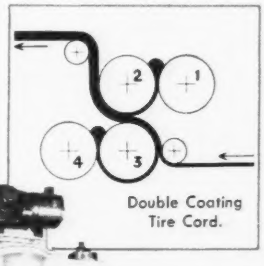
This high-speed unit incorporates a separate pinion gear stand which encloses all drive gears and connecting gears, driving the rolls individually through universal couplings. The peripherally drilled rolls are accurately controlled by a pressurized circulating water temperature regulation system.

In addition to the unit shown, a modified calender, incorporating crossed axis equipment on only the #1 or the #4 roll is available for plastic film or sheeting. Adamson also manufactures a 24″ Zee-type calender, along with a special 6-roll double Zee-type unit.

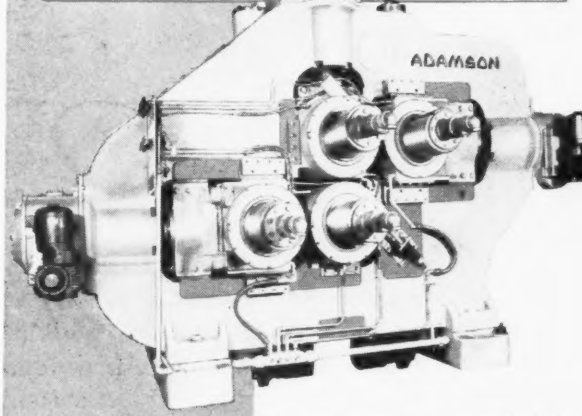
We invite your inquiries.



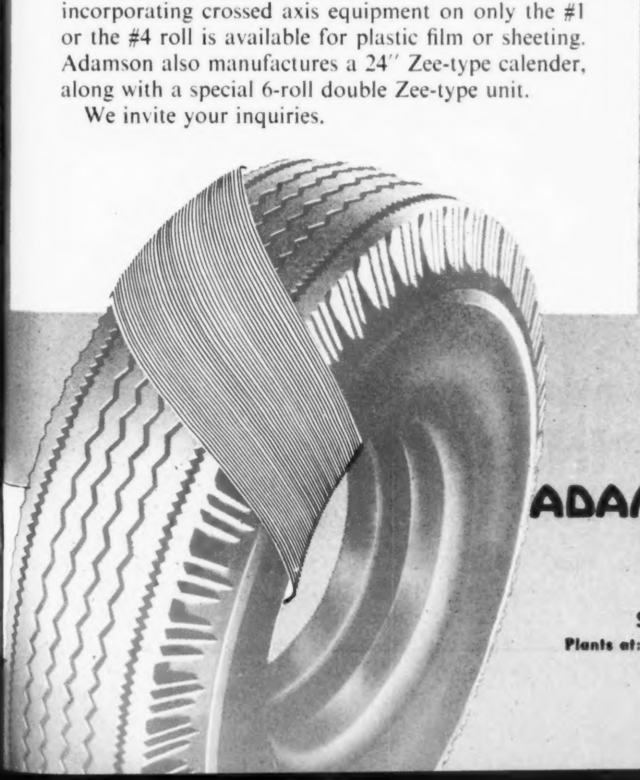
Two-ply Rubber Thread or Sheet.



Double Coating Tire Cord.



Both offset rolls (#1 and #4) are "crossed" in the vertical plane by motorized adjustments allowing operator to compensate for deflection of the rolls. The operator can add or subtract crown, in effect, by changing the amount of crossing of the two offset rolls with respect to the two stack rolls. Selsyn equipment and counters are provided for indicating the exact vertical position of each end of the crossed rolls.



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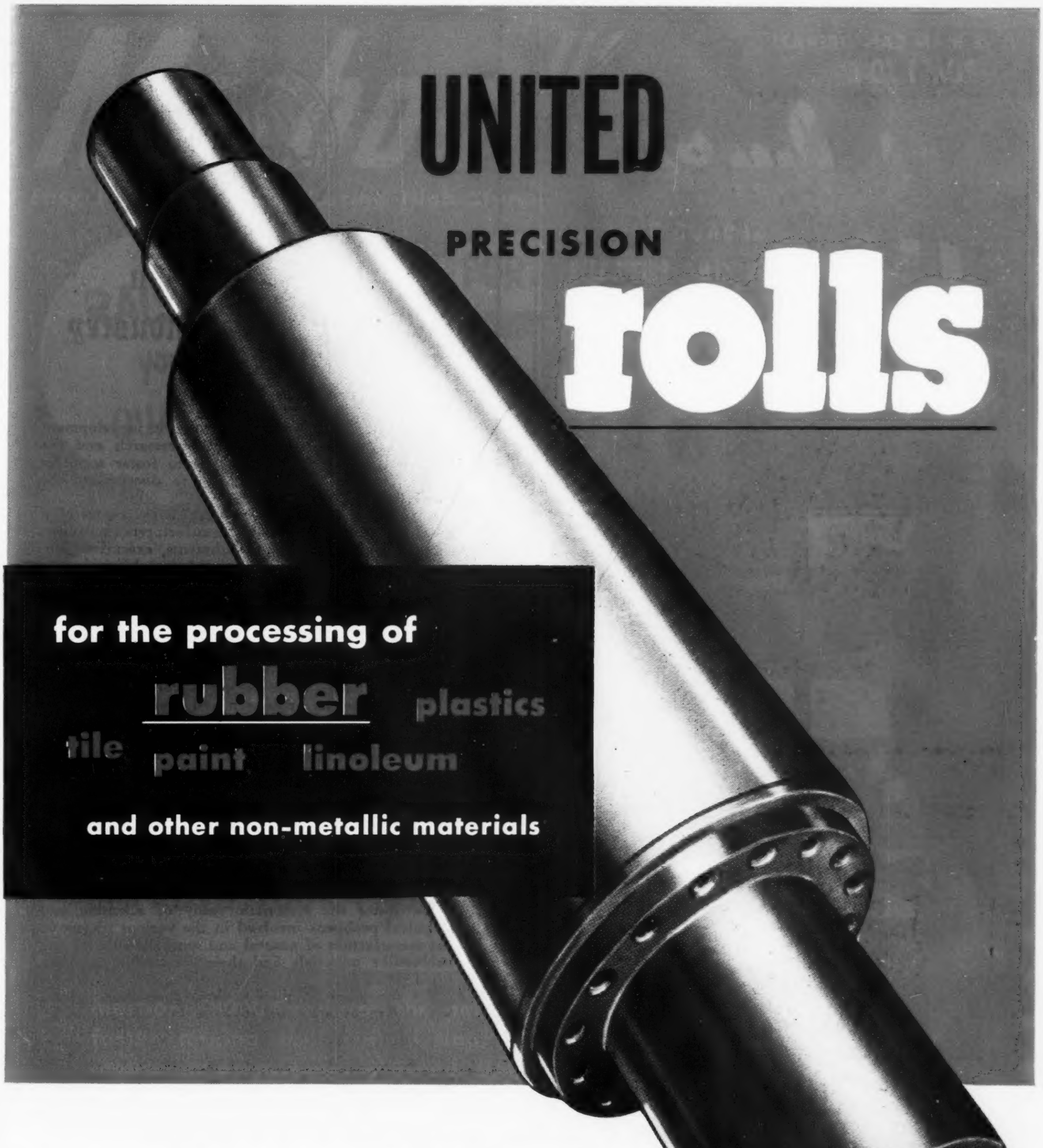

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JUNE, 1953
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INDIA
RUBBER
WORLD

VOL. 128—NO. 3 JUNE, 1953

Influence of Variations in Rotors, Dies, and Rate of Shear on Mooney Viscosity[1]

George E. Decker[2] and Frank L. Roth[2]

THE Mooney viscometer is a shearing disk type of instrument designed by Mooney[3] in 1933 for use in measuring the viscosity of rubber and rubber compounds for control of factory processing. In 1942 this viscometer was adopted for use in control of the viscosity of synthetic rubbers produced in government plants.[4] Two problems encountered during the use of the Mooney viscometer for control of production have been responsible for the investigations reported here. The first is one common to the use of any test instrument in a number of plant laboratories, that is, control of the instrument variables in order to obtain reproducible results between laboratories. The second is introduced with the measurement of Mooney viscosity of GR-I and GR-S rubbers having high molecular weights.

Several plants reported that different commercial rotors yielded different viscosities for the same rubber. An investigation of variations in dimensions of a number of these rotors showed that the Mooney viscosity was not significantly affected by (1) variations up to 0.002-inch in the diameter or thickness of the rotor heads, (2) eccentricities of the 0.001- to 0.008-inch of the heads relative to the stems, or (3) lack of perpendicularity of 0.1- to 0.34-degree of the plane of the head to the axis of the stem. It was found, however, that the depth of the serrations in the rotors, which varied from 0.014- to 0.035-inch, had a significant effect on the observed viscosity.[5] This observation led to a study of rotors and dies having no serrations. These rotors facilitated the study on the effect of large variations in the thickness and diameter of the head.

The second problem was first encountered with GR-I. The plants reported that as the molecular weight was increased, the viscometer readings approached a limiting value between 80 and 85. Further, these values did not correlate with the molecular weight determined from the viscosity of dilute solutions. An investigation of this problem led to a study of the effect of temperature and of rate of shear.

The viscometer readings for GR-S of high molecular weight (used for the production of oil-extended rubber) were also lower than indicated by the amount of oil which had to be added. For some of these rubbers it was found that slippage at the rotor surface was involved and that the amount of slippage depended upon the nature of the surface.

Apparatus

Two Mooney viscometers were used in this investigation. Both viscometers were steamheated, using connections and controls similar to those described by Taylor, Fielding, and Mooney.[4] The temperature was measured by means of thermocouples embedded in the dies. The steam pressure was adjusted to maintain a temperature of 212° F. in each die after steady-state conditions were reached with the dies closed. Since the lower die had a tendency to become slightly hotter than the upper one, a manually controlled valve was placed in the steam entrance line to the lower platen. This valve permitted the flow of steam to be adjusted to equalize the temperature in the two dies. The use of an autographic temperature recorder permitted temperatures of the dies to be recorded for each viscosity measurement. The temperature of the dies decreased upon insertion of a new specimen, but returned to about 211° F. in five minutes and to essentially 212° F. in eight minutes. These temperatures were reproduced to within 0.1° F. from one test to another. When experiments requiring frequent interchanges of rotors were conducted, the spare rotors were stored in an oven at 212° F.

The Mooney viscosities or viscometer readings for both machines were recorded autographically. The pickup for one viscometer was a differential transformer oper-

[1] The work discussed herein was performed as a part of the research project sponsored by the Reconstruction Finance Corp., Office of Synthetic Rubber, in connection with the Government Synthetic Rubber Program.

[2] National Bureau of Standards, Washington, D. C.

[3] "A Shearing Disk Plastometer for Unvulcanized Rubber." M. Mooney, *Ind. Eng. Chem. (Anal. Ed.)*, 6, 147 (1934).

[4] "Development and Standardization of Tests for Evaluating Processibility of Rubber." R. H. Taylor, J. H. Fielding, M. Mooney, in "Symposium on Rubber Testing," p. 36. Special Technical Publication No. 74, American Society for Testing Materials, Philadelphia (1947).

[5] The serrations in each face of the rotor and dies consist of two series of 1/32-inch grooves cut at right angles and forming pinnacles 1/32-inch square and 0.014- to 0.035-inch high.

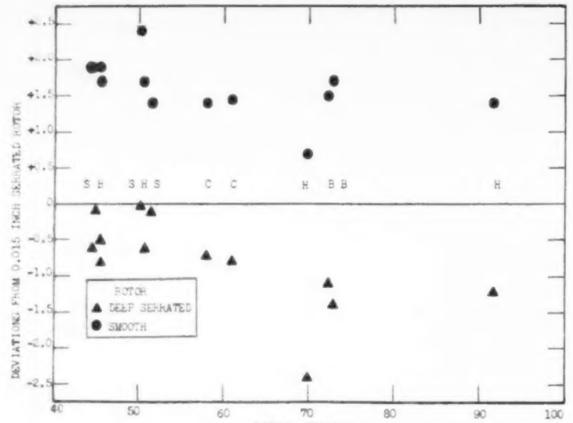

Fig. 1. Effects of Depth of Serrations in Rotor on the Mooney Viscosity
The letters S, B, and H refer, respectively, to GR-S, Butyl (GR-1), and *Hevea* rubbers, and C refers to carbon black compounds of GR-S

ated by the linear motion of the stem of the dial gage, and the pickup for the other machine was a pair of electrical strain gages mounted on the U-spring. All the viscometer readings were read from the recorder charts.

A direct current motor and a Thymotrol control were used in connection with mechanical speed reducers to obtain the various rotor speeds.

Depth of Serrations

Three rotors 1.5 inches in diameter were used to investigate the effect of the depth of serrations on the observed values of Mooney viscosity. Two of these were selected from rotors supplied commercially, in which the depths of the serrations were 0.015- and 0.030-inch, respectively. The third rotor was made of hardened tool steel and had no serrations. The overall dimensions of all three rotors were within normal tolerances of ±0.001-inch in diameter and thickness. Two sets of dies were used in this study. One set was supplied commercially and had serrations about 0.015-inch deep. The other set had no serrations and was designed with each die and die holder in an integral unit. The depth of the specimen cavity formed by these dies was made slightly greater than that formed by the commercial dies in order to obtain equivalent viscosity readings. These dies were made of tool steel and hardened.

Viscosities of several rubbers and rubber compounds were measured with each of the three rotors and each of the two sets of dies. The specimens for these viscosity determinations were allowed to warm up in the viscometer for one minute before the motor was started, and the viscosities were observed from the recorder chart after eight minutes of shearing. The data for the individual measurements are shown in Table 1.

A summary of the deviations of the values observed for the rotor with serrations 0.030-inch deep and of those for the smooth rotor from the values observed for the rotor with serrations 0.015-inch deep is shown graphically in Figure 1. These data show that there is a decrease in the observed values of Mooney viscosity as the depth of the serrations is increased. The fact that the smooth rotors and smooth dies yield values which are never less than those obtained with serrated rotors and dies indicates that the serrations are not necessary for these rubbers.

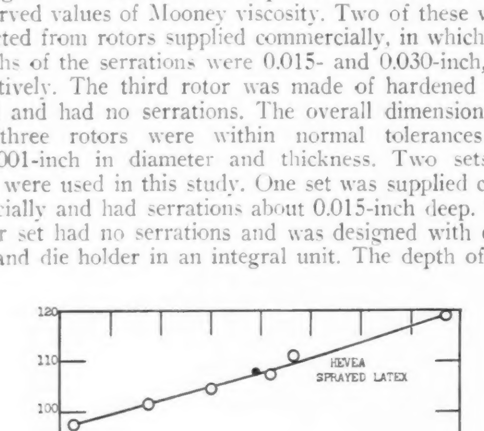

Fig. 2. Effect of Variations in Thickness of a Smooth Steel Rotor on the Viscometer Reading
The solid points were obtained with a commercial rotor having serrations 0.015-inch deep

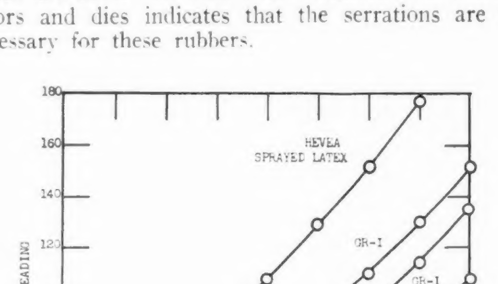

Fig. 3. Effect of Variations in Diameter of a Smooth Steel Rotor on the Viscometer Reading

TABLE 1. EFFECTS OF DEPTH OF SERRATIONS IN THE ROTOR ON THE MOONEY VISCOSITY OF SEVERAL RUBBERS

	Viscometer Readings					
	Serrated Dies			Smooth Dies		
	Depth of Rotor Serrations			Depth of Rotor Serrations		
Rubber	0.030-In.	0.015-In.	0.000	0.030-In.	0.015-In.	0.000
Y-108 GR-I*	44.8	45.5	47.2	44.7	45.5	47.2
	44.9	45.1	47.3	—	—	—
Y-107 GR-I*	71.0	72.1	73.8	71.3	72.7	74.1
	71.2	72.4	73.6	71.5	73.0	74.8
X-603 GR-S*	50.3	50.2	53.1	52.2	51.4	53.4
	49.7	50.5	52.1	50.9	51.9	52.7
X-672 GR-S*	44.2	44.4	46.2	43.8	44.4	46.2
	44.8	44.8	46.8	44.0	44.6	46.5
Hevea (pale crepe) Well masticated	—	—	—	49.8	50.4	52.2
	—	—	—	50.3	50.8	52.4
Moderately masticated	66.5	69.6	70.6	—	—	—
	68.4	69.9	70.4	—	—	—
Slightly masticated	90.7	91.4	93.2	—	—	—
	90.5	92.3	93.2	—	—	—
X-629 GR-S compound*	—	—	—	60.0	60.8	62.4
	—	—	—	59.9	60.9	62.2
X-603 GR-S compound*	57.5	57.8	58.8	—	—	—
	57.0	58.0	59.8	—	—	—

* Specimens were prepared according to the procedure given in the "Specifications for Government Synthetic Rubbers."

Thickness and Diameter of Rotors

A number of rotors of various thicknesses, all having a diameter of 1.500 inches, were constructed from cold rolled steel for the study of the effect of thickness on the viscometer readings. Since it was shown that serrations were not required to prevent slippage between the rubber and the metal for most commercial rubbers, these rotors were left smooth. A thin rotor could then be made from a thick one by the removal of equal thicknesses of metal from the top and bottom faces. Care was taken to have all the rotors constructed so that thickness of the rubber specimen above and below the rotor faces was equal. In order to study the effect of the diameter of the rotor on the viscometer reading several smooth rotors of different diameters, but having the same thickness (0.224-inch), were constructed.

Some of the rotors having the smaller diameters were constructed by the removal of metal from the circumference of large rotors. Commercial dies with the serration 0.015-inch deep were used for these studies.

The effects of thickness and diameter on the viscometer reading were obtained for five rubbers ranging in Mooney viscosity from about 45 to 105 units. Three of these rubbers were GR-I synthetic rubbers since this type of rubber requires no mastication in the preparation of the specimens and yields very reproducible results. The sprayed latex sample of *Hevea* rubber was selected for its relatively high viscosity, and it also required no mastication in preparation of the specimens. The X-603 GR-S synthetic rubber was included to extend the study to this type of rubber. The sample of GR-S, however, was mill-massed previous to the test, following the procedure outlined in the "Specifications for Government Synthetic Rubbers."[6] All the rubber specimens were allowed to heat for one minute in the viscometer before the motor was started. Viscometer readings were taken after four minutes of shearing for the GR-S and after eight minutes for the GR-I and *Hevea* rubbers.

The results are shown graphically in Figures 2 and 3. The Mooney viscosity of each rubber, using a commercial rotor with serrations 0.015-inch deep, is also shown in Figure 2. The fact that these points lie below the curves for the rubbers having Mooney viscosities less than 70 units is in accord with the results shown in Figure 1 and Table 1, indicating that there is no slippage at the rubber-metal boundaries. However, the Mooney viscosities obtained for the GR-I-18 and the *Hevea* rubber, using the serrated rotors, are slightly greater than the viscometer readings given by the curves for the smooth rotors. This difference could be attributed to a slight slippage at the rubber-metal boundary for the smooth rotors.

The change in viscometer reading per mil (0.001-inch) variation in thickness or diameter of the rotor determined, respectively, from Figures 2 and 3 are given for each rubber in Table 2. It is observed that the change in the viscometer reading per mil variation in thickness or diameter is approximately 0.2% in most cases. For a rubber having a Mooney viscosity of 50 units the change in reading would be about 0.1 unit per mil change in thickness or diameter. This value is somewhat smaller than that calculated by Taylor.[7] It is believed that the higher values calculated by Taylor, particularly for variation in thickness, result from his assumption that the actual viscosity of a rubber is independent of the rate of shear. The low % change per mil change in thickness of the rotor shown for *Hevea* in Table 2 can be attributed to a very rapid decrease in the actual viscosity with increasing rate of shear. In this connection it should be emphasized that increasing the thickness of the rotor predominantly increases the rate of shear; whereas increasing the diameter increases the shearing area with only a slight increase in the average rate of shear.

Table 2. Effect of Variations in Thickness and Diameter of the Rotor on the Viscometer Reading

Rubber	Y-103 GR-I	X-603 GR-S	Y-106 GR-I	GR-I-18	*Hevea*
Effect of Thickness					
Reading for a thickness of 0.218-inch	49.0	56.6	66.3	77.8	107.1
Slope at a thickness of 0.218-inch					
Change in reading per mil change in thickness	0.093	0.099	0.140	0.161	0.146
% change in reading per mil change in thickness	0.190	0.176	0.212	0.206	0.136
Effect of Diameter					
Reading for a diameter of 1.5 inches	50.0	57.4	67.2	78.5	108.0
Slope at a diameter of 1.5 inches					
Change in reading per mil change in diameter	0.092	0.097	0.126	0.146	0.200
% change in reading per mil change in diameter	0.184	0.170	0.188	0.186	0.186

Speed of Rotor

The GR-I synthetic rubber plants reported that viscometer readings at 212° F. for various GR-I rubbers of high molecular weight were all between 75 and 85 and did not correlate with the molecular weight determined from viscosities of dilute solutions. They also reported that these rubbers could be better differentiated by measuring the viscosity at a higher temperature. It appeared that the rate of shear in the Mooney viscometer was too great to differentiate these rubbers at 212° F. Consequently in the present investigation Mooney viscosities of a series of such rubbers were measured (1) at elevated temperatures and (2) at 212° F., but the speed of the rotor was decreased below two revolutions per minute.

Table 3. Viscometer Readings for Samples of GR-I

		Viscometer Readings			
Temperature, °F.		212	260	292	212
Rotor Speed, r.p.m.		2	2	2	0.01
Sample	Mol. Wt.*,x10³				
1	82	70.0	65.0	62.5	26.0
2	69	75.5	73.0	67.5	14.5
3	62	78.5	71.0	58.0	10.8
4	54	85.0	63.0	49.5	8.5
5	52	82.3	56.5	46.5	6.5

* Staudinger molecular weights reported by the GR-I synthetic rubber plant at Baton Rouge, La.

Table 3 lists the viscometer readings observed for a rotor speed of 2 r.p.m. at temperatures of 212, 260, and 292° F.; those for a rotor speed of 0.01 r.p.m. at 212° F.; and molecular weights determined at the GR-I plant at Baton Rouge, La., from viscosities of dilute solutions. It is seen that viscometer readings for 2 r.p.m. at 212° F. show no correlation with the molecular weights. Increasing the test temperature results in better correlation, but even at 292° F. the apparent Mooney viscosity of Sample 1 is less than that of Sample 2. On the other hand, the viscometer readings for a rotor speed of 0.01 r.p.m. place all the rubbers in the order of their molecular weights. It appears likely that a further increase in the temperature would also yield better correlation between molecular weight and viscosity, but problems of temperature control and maintenance of the viscometer would prohibit its use for extensive control testing at such high temperatures. It appeared desirable, therefore,

[6] "Specifications for Government Synthetic Rubbers," Revised Edition. Reconstruction Finance Corp., Office of Rubber Reserve, Washington, D. C. (1951).

[7] "Factors Affecting Results Obtained with the Mooney Viscometer." India Rubber World, 112, 582 (1945).

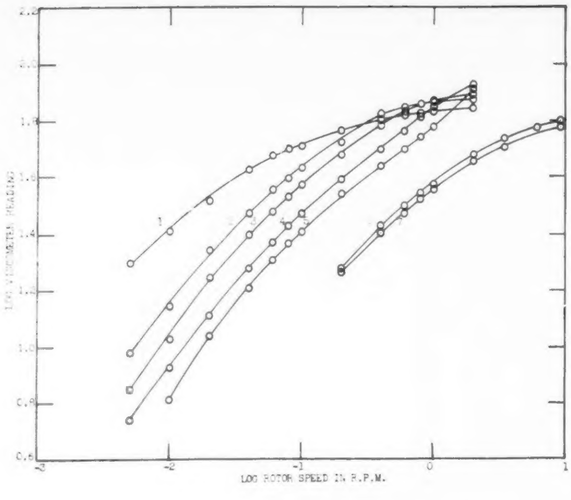

Fig. 4. Effect of Variations in Rotor Speed on the Viscometer Readings for GR-I

The numbers 1 to 5 refer to samples of GR-I having high molecular weight; 6 and 7 refer to Y-103 and Y-108 GR-I, respectively

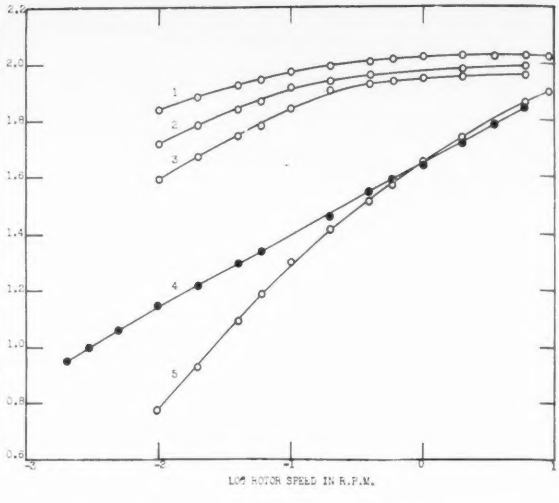

Fig. 5. Effect of Variation in Rotor Speed on Viscometer Readings for Hevea and GR-S Rubbers

Curves 1 and 2 are for pale crepe and smoked sheet as taken from the bale; 3 is for slightly masticated smoked sheet; 4 (filled circles) is for X-603 GR-S mill-massed according to the procedure given in the "Specifications for Government Synthetic Rubbers"; and 5 is for well-masticated pale crepe

to investigate the effect of reducing the rotor speed and maintaining the temperature at 212° F.

Figure 4 shows the relation between the viscometer readings (shear stress) and the speed of the rotor (rate of shear) for the series of five samples of GR-I listed in Table 3. The speeds range from 0.005 to 2 r.p.m. Viscometer readings for Y-103 and Y-108 GR-I are also shown for speeds ranging from 0.2 to 9 r.p.m.

The data in Figure 4 indicate that at slow speeds the shear stress increases rapidly with rate of shear for all the rubbers. The rate of increase becomes less marked as the speed increases, and for Samples 1, 2, and 3 the shear stress becomes nearly constant at speeds in the neighborhood of 2 r.p.m. In the case of Sample 1 the specimens show evidence of crumbling at the higher speeds.

In view of this behavior of GR-I a similar study was made for *Hevea* and GR-S rubbers. Figure 5 shows the relation between viscometer readings and the speed of the rotor for four samples of *Hevea* rubber and for X-603 GR-S. Curves 1 and 2 were obtained with specimens of pale crepe and smoked sheet, respectively, cut directly from the bale. Curve 3 shows the effect of passing a sample of smoked sheet a few times through a laboratory mill. Curve 5 shows the effect of masticating the pale crepe for 10 minutes on the mill with unheated rolls. The GR-S used for Curve 4 was mill-massed according to the procedure designated in the "Specifications for Government Synthetic Rubbers."

The data for the unmasticated *Hevea* rubbers show little change in shearing stress for speeds from one to 10 r.p.m. Consequently it is not to be expected that measurements on unmasticated *Hevea* rubbers would have any significance for predicting their processibility. Mastication of these rubbers caused a large decrease in shearing stresses at low speeds, but the effect becomes relatively small at the higher speeds.

Scott[8] reported similar studies on GR-S and *Hevea* rubbers. He found a linear relation on a log-log scale between the viscometer reading and the rotor speed. It is noted that Curve 4 for GR-S is essentially linear, but the curves for *Hevea* are not. Comparison of Curves 1 and 5 indicates that a more nearly linear relation might have been obtained had the proper degree of mastication been selected. Figure 5, however, shows that such a relation is not an inherent characteristic of rubber.

Slippage on the Surface of the Rotor

In the investigation of smooth rotors it was observed that rotors which were chromium plated yielded lower Mooney viscosities than rotors made of cold rolled steel. This difference in behavior led to the study of other metals plated on the surface of the rotors. In all, seven plated rotors and one unplated tool steel rotor were used. The plated rotors had the following metal surfaces: cadmium, chromium, cobalt, copper, gold, silver, and zinc. The viscometer readings obtained with these rotors were dependent on both the rubber and the metal. Usually the rotors plated with gold, silver, or copper yielded higher viscometer readings than those plated with cadmium. The difference in readings was dependent on the rubber. For some rubbers essentially the same value was obtained with all the rotors; whereas for other rubbers there was a difference of more than 100 units. Where there was a large difference, the rotors plated with chromium, zinc, or cobalt and the unplated steel rotor yielded intermediate viscometer readings.

TABLE 4. VISCOMETER READINGS USING ROTORS WITH DIFFERENT METALS ON THE SURFACES

Rubber	Serrated Chromium Plated	Smooth Gold Plated	Smooth Steel	Smooth Chromium Plated	Smooth Cadmium Plated
Y-108 GR-I	46.0	48.2	47.9	47.4	47.1
GR-I-18	81.8	82.6	82.3	81.9	82.0
Hevea (pale crepe)	107.0	105.0	109.0	106.4	77.9
X-672 GR-S	44.4	47.2	46.2	46.8	47.2
X-603 GR-S	51.4	53.2	52.4	54.3	13.6
GR-S-1700 (base polymer)*	117.4	125.5	124.0	123.7	103.2
GR-S (A)†	124.0	113.4	101.2	89.7	75.0
GR-S (B)†	152.5	151.0	126.0	85.0	39.0
GR-S (C)†	166.4	143.4	138.0	135.2	134.8
X-603 GR-S Compound‡	62.5	62.8	63.6	64.5	44.0
GR-S-1800 Compound	81.6	84.0	78.0	77.8	74.2

* Sample of latex taken before the addition of processing oil.
† Experimental polymer having high molecular weight.
‡ Prepared according to the procedure given in "Specifications for Government Synthetic Rubbers."

Viscometer readings are given in Table 4 for 11 rub-

[8] "Rubber Plastometer with Uniform Rate of Shear—Shearing-Cone Plastometer." G. H. Piper and J. R. Scott, *J. Sci. Instruments, 22,* 206 (1945); *Rubber Chem. Tech.,* 19, 822 (1946).

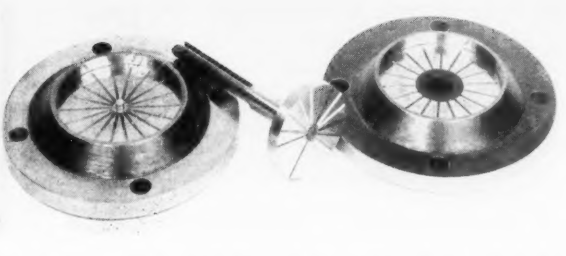

Fig. 6. Rotor and Integral Die and Die Holder Having 18 Radial Grooves Instead of the Usual Serrations

bers and rubber compounds determined with smooth rotors plated with gold, chromium, and cadmium and the unplated steel rotor. For comparison the viscometer readings determined with the usual chromium plated serrated rotor are also given. The values for the GR-I rubbers were observed after eight minutes of shearing; all other values were observed after four minutes.

It is seen from Table 4 that except for the three experimental polymers the viscometer readings show no evidence of greater slippage for three of the smooth rotors (gold-plated, chromium-plated, and unplated steel) than for the serrated rotor. In fact, the values obtained for the base polymer of GR-S-1700 with these three rotors are appreciably greater than those obtained with the serrated rotor. The results obtained with the smooth cadmium-plated rotor were erratic and frequently much lower than those obtained with the other metals. In the case of the three experimental polymers it is questionable whether the values obtained with any of the rotors are a true measure of the characteristics of the polymer.

Discussion

It appears from the data presented in this paper that smooth steel rotors and dies are as satisfactory as serrated ones for determining the Mooney viscosity of commercial rubbers. Serrations, however, appear to reduce the amount of slippage of some rubbers having very high molecular weight and of some rubber compounds. The principal disadvantages of the present serrations are: (1) the design permits rubber to slip or shear along the portions of the grooves which are in line with the direction of motion; and (2) pinnacles at the edges of the rotor are easily broken.

These disadvantages can be overcome by the use of radial grooves, as shown in Figure 6. Rotors and dies of this type have the following advantages over the present serrated ones: (1) since the grooves are always perpendicular to the direction of motion so that the rubber cannot slip or shear along them, their depth is not critical; (2) the dimensions of the rotor are more stable since there are no small pinnacles at the edge which break off or wear rapidly; (3) the relatively large smooth areas and V-grooves contribute to greater ease in removing the sample and cleaning the metal surfaces; and (4) the V-grooves permit the die and die holder to be fabricated as an integral unit.

The dies in Figure 6 are constructed integral with the die holders. On each face there are 18 radial V-grooves, each of which forms a 90-degree angle at the bottom and is 0.015- to 0.020-inch deep. This type of construction has the following advantages over the present two-piece construction: (1) the rate of heat transfer from the platens to the rubber is greater so that steady-state temperature conditions are reached sooner; (2) the mating surfaces forming the die cavity are not distorted when the bolts securing the dies are tightened; and (3) the interfaces between the dies and the die holders are eliminated, thereby reducing the number of surfaces which must be cleaned whenever the dies are removed.

The data obtained in studies of the effects of the speed of the rotor on the Mooney viscosity indicate that the rate of shear for a rotor speed of two revolutions per minute is too great to characterize rubbers having high molecular weights. At very low speeds, however, the accuracy of the measurements is impaired since the torque on the rotor becomes sufficiently small that it is comparable with frictional forces in the viscometer. Also, the time involved in determining the viscosity becomes too great for control testing since the torque on the rotor increases only slowly to a limiting value after starting the motor. At rotor speeds in the region of 0.01 r.p.m. the time for the torque to reach a limiting value is often in the order of 30 minutes. It would appear that for a rotor speed of 0.1 r.p.m. the time required to obtain a reliable reading is not excessive (of the order of 10 minutes), the frictional forces in the viscometer can be kept small compared to the torque on the rotor, and the viscometer readings distinguish between all rubbers of high molecular weight that are produced commercially and between most of the rubbers produced experimentally in the laboratory or pilot plant. Caution must be used in interpreting results for experimental rubbers of extremely high molecular weight for which a speed of 0.1 r.p.m. may still be too great.

Summary and Conclusions

The principal findings of this investigation on Mooney viscosity are: (1) viscometer readings decrease slightly as the depth of the serrations increases; (2) serrations are unnecessary to measure the viscosity of commercial rubbers; (3) the viscometer reading is increased about 0.2% by an increase of 0.001-inch in either thickness or diameter of the rotor; (4) a rotor speed of 2 r.p.m. is too great to characterize rubbers having very high molecular weights; and (5) the likelihood of slippage depends on both the kind of rubber and the kind of metal on the surfaces of the rotors and dies. To improve the reliability of Mooney viscosity measurements it is recommended that: (1) radial V-grooves replace the serrations on the rotor and dies; (2) chromium plating of the rotor and dies be eliminated; (3) die and die holder be constructed as an integral unit; and (4) the speed of the rotor be reduced to 0.1 r.p.m. or less for rubbers having very high molecular weights.

Air Mattress for Combat Injured

A LIGHTWEIGHT, inflatable "air mat," designed to make injured men in combat areas more comfortable while receiving treatment, is being manufactured for the Armed Forces by Goodyear Tire & Rubber Co., Akron, O. The mattress is constructed in two sections, one atop the other, of nylon fabric laminated on both sides with neoprene rubber. Dropped pile threads woven between the three nylon layers serve as control spacers to prevent the unit from assuming a spherical shape when it is inflated. The mats cover an area of 74 by 30 inches when inflated; in the deflated form, they may be rolled into a bundle which can be easily carried under the arm of a corpsman.

Pneumosilicosis

Sebastian Ambery, M.D.[1]

WE ARE indebted to U. H. Parker, plant manager, Dryden Rubber Division, Sheller Mfg. Corp., Keokuk, Iowa, for this report by Dr. Ambery on the possibility of silicosis to employes exposed to mica dust in rubber-plant operations. It is concluded that the particle size of mica used in rubber-plant operations is generally too large to cause pulmonary silicosis. EDITOR.

DUST of one kind or another is all-pervading. It has far-reaching effects on civilized man and is all-working and can be appreciated fully by the fact that dust is any substance which is so divided that the particles are small enough to be blown by the wind. Also dust may affect the lungs in some cases seriously. It is the toxic inorganic dusts which are the most important since among them are those dusts which permanently affect the essential pulmonary tissues.

Pneumoconiosis, a term used to describe pulmonary fibrosis (connective tissue proliferation), is produced by inhaling dust; pneumosilicosis is fibrosis of the lungs due to inhalation of silica dust. It is recognized today that diffused fibrosis of the lungs is the result of dust inhalation of two classes of substances only: namely,

(1) Dust containing silica in the free form as SiO_2 (quartz, flint, sandstone);

(2) Dusts in which the silica is compressed with bases as silicates (asbestos).

According to A. J. Amor, the dusts containing free silica are by far the most important, and the higher the proportion of free silica, the more dangerous the dust. It is surmised that the dangerous potentialities might be dependent primarily on a physical characteristic. It can also be shown that other fibrous silicates or plate silicates, such as mica, might exert a similar action if the particles are of a specified size. Sericite, a hydrous silicate of potassium and aluminum, also contains the aforementioned dangerous characteristic.

Two factors of dust affect us primarily: (1) the concentration of the dust cloud; (2) the size of the particle.

Concentration of the Dust Cloud

It appears there must be a safe limit of dust concentration, exposure to which causes neither a disablement during the working lifetime nor a shortening of the normal span of life. Unfortunately determining this safe limit is not an easy task. In the first place, since a diagnosable case of silicosis is usually the result of years of exposure to the dust, the determination today of the concentration of dust which has caused silicosis in any particular case is a matter of extreme difficulty because conditions of work may and probably have altered materially during the past twenty years. Secondly, the technique of dust counting is not uniformly comparable.

The Size of the Particle

The maximum allowable concentration in air is fifty million particles of mica dust per cubic foot. However, the size of the particles of dust is obviously as important as limiting the dust to be observed in the air and the amount which can be inhaled into the lungs. The dangerous particle sizes range up to ten microns (one micron is one-thousandth part of one millimeter). The majority of the particles which get into and stay in the lungs are much smaller, up to five microns in the case of silica dust. Thus the dangerous particles are invisible to the naked eye, and the air of a room appearing to be only slightly dusty to the naked eye may be exceedingly dangerous.

It is generally accepted that the silicates must exist in a free state as silicon dioxide before the destructive fibrosis can take place. There is little evidence substantiating proof that in the compressed state silica, i.e., mica, is capable of producing pulmonary fibrosis, except asbestos. Gardner reported that a few silicates, such as mica, provoke some chronic pulmonary inflammation, but that this reaction tends to retrogress with no progression to the stage of true fibrosis after some months without contact.

According to Policard, mica dust inhaled experimentally produces changes in those lung cells which act as phagocytes (any cell that destroys micro-organisms or harmful cells) against the dust. Cellular mummification then takes place. The altered cells are grouped in plaques in the lung alveoli (little hollows of air). About them the pulmonary histocytes (large phagocytic intersticial cells) gather; the aggregate forms a wall of mica granuloma (a tumor of granulation tissue). These pathological alterations, he claims, are supposed to be identical to those produced under the same experimental conditions by inhalations of various siliceous rock dusts, but nowhere in his paper on this subject does he mention the size of the dust particle. We must therefore assume that this, too, must fall into the five-micron group size.

Jones studied the mineral particles found in the lungs and met with various forms of pulmonary silicosis. He found that the free silicate particles were relatively few and not in proportion to the lesions observed. To the contrary he found an abundance of the mineral (sericite) which he held responsible for the pathology found in the lung. A sericite, as stated above, is a hydrous silicate of potassium and aluminum formed by the alteration of felspar. This mineral is always present in abundance in rocks recognized as producing silicosis. This fact leads to the conclusion that it is highly possible that the toxicity of silicon rock is not due exclusively to free silica, but due to sericite.

Summary and Conclusions

Therefore, in conclusion, from the pathological standpoint, those dusts containing free silicate or sericite cause a silicosis if inhaled in sufficient quantities provided the size of the mica particle is between one and ten microns. The size of the mica particles generally used in dusting rubber is about 312 microns and therefore is not noxious as the causation of pulmonary silicosis. The aforementioned demonstrates how fragile and uncertain is the pathogenic basis for the current conception of pulmonary silicosis due to mica dust. In fact, Winstead and Joliet, after examining 1,121 men were unable to prove conclusively that mica, a silicate, is responsible *per se* for the increase of chest pathology.

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(1) Arthur J. Amor, "An X-Ray Atlas of Silicosis," pp. 254-56. William & Wilkins Co., Baltimore, Md. (1941)

(Continued on page 353)

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Methods Employed in Compounding Research—VIII[1]

Ingredients for Compounding Research

I. Drogin[2]

THE following installment continues the section on ingredients for compounding research which was begun in our December, 1952, issue. Part I of this series appeared in our October, 1952, issue.

Acrylic Rubber

Polyacrylic rubbers are a family of thermoplastic chemically saturated elastomers which cure in the presence of certain organic or inorganic bases and can be processed on standard rubber equipment. These rubbers, as pointed out by Owen (144), make possible the fabrication of rubber products which will withstand hot oils at 300-350° F. for extended periods, remain unaffected by oxygen and ozone, and show outstanding resistance to discoloration by sunlight.

A typical polyacrylic rubber is Goodrich Chemical's Hycar 4021 (formerly PA-21) (145), which is a copolymer of an acrylic acid ester and a halogen-containing derivative. Elastomers similar to Hycar 4021, one of which was called Lactoprene EV, and another Lactoprene BN, were pioneered by the Eastern Regional Research Laboratories, United States Department of Agriculture. Lactoprene EV, an acrylic copolymer made from a monomer charge composed of 95% ethyl acrylate and 5% chlorethyl vinyl ether, has been described in several articles (146). Lactoprene BN, a copolymer of butyl acrylate and acrylonitrile, of which a typical composition is 90 butyl acrylate and 10 acrylonitrile, was developed by Dietz and Hansen (147). Its preparation and properties are described by Filachione, Fitzpatrick, Rehberg, Woodward, Palm, and Hansen (148), who likewise prepared copolymers of various acrylic esters, from ethyl to octyl, with 5% to 15% acrylonitrile or methacrylonitrile.

Polyacrylic rubber, Hycar 4021, is chemically saturated; therefore, crosslinking or vulcanization cannot occur in the same manner as in chemically unsaturated natural, GR-S, nitrile, neoprene, and butyl rubbers. This thermoplastic polymeric material, however, is responsive to certain processes which convert it from thermoplastic to thermosetting or "cured."

The development of more rapid vulcanization procedures of saturated acrylic elastomers is described by Mast, Dietz, and Fisher (149), who were of the opinion that it is highly advantageous commercially to achieve vulcanization in 30 minutes or less. The vulcanization of chlorine-containing acrylic elastomers is also described by Mast and Fisher (150).

The normal curing agents for polyacrylic rubber, Hycar 4021, are amines such as Trimene Base, triethylene tetramine, tetraethylene pentamine, and hexamethylene tetramine. These materials may be used alone or in combination with other curing agents normally used for "conventional" rubbers. A combination of sulfur and trimene base produces stocks with excellent heat resistance. The sulfur is not necessary for cure, but serves the function of stabilizing the cured stock on prolonged exposure to high temperatures and acts as a retarder of cure in the uncured state. Effective vulcanizing agents for polyethyl acrylate are, according to Semeben and Wakelin (151), sodium or potassium hydroxide, lead oxide, sodium stannate, sodium ortho vanadate, and sodium metasilicate pentahydrate and nonahydrate. In view of the completely saturated chemical nature of polyethyl acrylate, sulfur and conventional accelerators will not convert the plastic to an elastic.

Properties of polyacrylic rubber vulcanizates are much more sensitive to pigmentation changes than those of most conventional rubbers, principally because their vulcanization depends largely on maintenance of a basic pH in the uncured stocks. Fillers, reinforcing pigments, plasticizers, lubricants, etc., should be chosen with this thought in mind. Clays, acidic plasticizers, or other pigments which absorb or react with bases should be avoided. Inert or slightly basic pigments are preferred. However, as pointed out in Service Bulletin H-11 (145), mildly acidic EPC carbon black can be used if sufficient additional amine is added to replace that which is absorbed by the black. Carbon blacks perform the same function in Hycar 4021 as they do in ordinary synthetic rubbers. In general, HMF, MAF, FEF, and HAF blacks give the best results. The optimum loading is 40 to 50 parts. EPC blacks with pH of 4 to 5 give slower curing and faster reversion during aging. A combination of EPC and HMF or HAF black is recommended to balance this effect.

Light-colored compounds made with Hycar polyacrylic rubber offer advantages for many applications because of their exceptionally good resistance to discoloration. Typical pigments are Silene EF, Hi-Sil, calcium carbonates, mica, asbestos, barytes, blanc fixe, Calcene T, mineralite Mica 4X, and diatomaceous earth. Pastel shades are usually obtained through the use of organic pigments such as benzidine yellow, lithol red, lima blue, and maroon toner. Inorganic metallic oxide color pigments should not be used because of their detrimental effect on cure rate and heat aging.

Polyacrylic rubbers are soft enough when vulcanized, and the use of plasticizers in Hycar 4021 compounds is, according to Goodrich Chemical (145), not recommended unless it is considered essential to improve low temperature flexibility. One or two parts of a suitable lubricant such as stearic acid, neutral #2 wool grease, Acrowax C, or Durez 13069 synthetic wax are recommended for Hycar polyacrylic rubber to prevent it from splitting and

[1] Based on a paper presented before the Ontario Rubber Section, C. I. C., Toronto, Ont., Canada, Mar. 11, 1952; The Los Angeles Rubber Group, Inc., Los Angeles, Calif., Apr. 1, 1952; and the Northern California Rubber Group, San Francisco, Calif., Apr. 10, 1952.

[2] Director of research, United Carbon Co., Charleston, W. Va.

[3] Numbers in parentheses refer to Bibliography items at the end of this installment.

adhering to the back roll of even a cold mill throughout the mixing cycle. Blends of Hycar polyacrylic rubber with other polymers seem to offer no advantages to the compounder.

Polyacrylic rubbers, as pointed out in Service Bulletin H-11, (145) require no breakdown period on a mill or in a Banbury; during the addition of curatives, the batch temperature should be between 150-175° F.; temperatures for calendering and extrusions must be maintained within a narrow range to prevent sticking or scorching; curing cycles are usually longer than for ordinary synthetic rubbers, and vulcanization is accomplished in 15 to 45 minutes at 310° F. in pressure molds or in autoclaves. Hycar 4021 can also be cured in an air oven. For development of best physical properties, particularly compression set, cured articles should be tempered in air 24-28 hours at 300° F., or 6-8 hours at 350° F.

The copolymers of various acrylic esters prepared by Filachione *et al.* (148) were easily vulcanized with sulfur and triethylene tetramine recipes. Their tensile strengths were significantly lower than those of many butadiene stocks. The vulcanizates of the butyl acrylate copolymers had substantially higher tensile strengths than the octyl acrylate copolymers of comparable acrylonitrile content. Increasing the acrylonitrile content of the copolymers appeared to increase the tensile strength. In general the tensiles decreased as the alkyl group of the acrylic ester increased. Experience indicates that the tensile strengths can be substantially increased by replacing SRF black with HAF black. The tensile strengths of the copolymers of the higher acrylates, particularly octyl acrylate, were increased by replacing part of the higher acrylate with ethyl acrylate.

Heat resistant vulcanizates were obtained by Filachione *et al.* (148) from the copolymers of acrylonitrile with ethyl, butyl, amyl, and hexyl acrylates, and also from the copolymer of methacrylonitrile with butyl acrylate. The octyl acrylate-acrylonitrile copolymers and the octyl acrylate, ethyl acrylate, and acrylonitrile terpolymers did not show similar heat resistance. Terpolymers obtained from ethyl acrylate, butyl acrylate, and acrylonitrile, however, produced heat-resistant vulcanizates. The butyl acrylate-methacrylonitrile copolymer appeared to have somewhat better heat aging properties than did the butyl acrylate-acroylonitrile copolymer.

Outstanding properties of polyacrylic rubber, Hycar 4021, are, according to Service Bulletin H-11, excellent resistance to temperatures up to 350° F.; resistance to oxidation at normal and elevated temperatures; resistance to hot oils and aliphatic solvents; excellent cut growth resistance; resistance to sunlight and ozone; resistance to permeability by gases such as hydrogen, helium, and carbon dioxide; and permanence of color in both white and pastel shades. Because of these special properties, Hycar polyacrylic rubber is recommended for products such as packings, oil and gasoline hose, O-rings, automatic transmission gaskets, transmission and conveyor belts, tank linings where either oil or high temperatures or both are encountered, grommets, mats, pads, protective covers, coatings (applied from solution) for paper, cloth, or fiber glass, and for use in white or pastel colored articles. Hycar polyacrylic rubber is not recommended for applications which require flexibility below —10° F., very high resistance to water, steam, ethylene glycol, or aromatic solvents.

The rubber industry, according to Semegen and Wakelin (151), is especially interested in the rubbery range of polyesters of acrylic acid, particularly polyethyl acrylate. Its physical properties are more readily adapted to rubber processing equipment and finished goods specifications than other alkyl acrylates.

Alfin Rubbers

Alfin rubbers, as pointed out by Morton (152), represent the development of a new type of polymer not at present in commercial production. By polymerizing butadiene and mixtures of butadiene and styrene with a special catalyst—combinations of sodium salts, one from an alcohol, and the other from an olefin in this case—a mixture of allyl sodium, sodium isopropoxide, and sodium chloride—polymers are obtained of unusually high molecular weight and general freedom from gel. Both the process and the polymers are, according to Morton (153), in a unique class because of the composition of the reagent; the enormous speed in polymerization; the inability to stop the process at intermediate points; the extraordinarily high molecular weight without cross-linking; and the predominantly 1,4-structure with regular crystalline pattern.

The properties of the Alfin polymers are those which might be expected from the unusually large molecular size. These polymers are difficult to break down on a mill. The viscosity of the raw polymer is very high. Heat alone causes the formation of a gel. Taft and Goldsmith (154), by blowing air into the Banbury while the copolymer was being worked, reduced the Mooney viscosity. Another obvious method of handling these polymers has been, according to D'Ianni and Taft (155) and Stewart and Williams (156), the use of solvents or oil diluents. When the material is compounded, the tests, according to D'Ianni, Naples, and Feld (157) and Taft and Goldsmith (154), show, in general, superior abrasion resistance, very high flex life, and excellent aging properties. The tensile strengths are low; the modulus is high, and the elongation at break less. The polymer can be set or vulcanized by heat without the necessity of incorporating sulfur. Pressure and heat can, according to D'Ianni, Naples, and Field (157), be used to shape and set Alfin polybutadiene.

Silicone Rubber

Silicone rubber is a high polymer made up of dimethyl siloxane units, which, according to Irby, Goss, and Pyle (158), possess the following structural formula:

$$\begin{array}{ccccc} CH_3 & & CH_3 & & CH_3 \\ —\ Si\ — & O — & Si\ — & O — & Si\ —O— \\ CH_3 & & CH_3 & & CH_3 \end{array}$$

Silicone rubber is produced by compounding a silicone gum with suitable fillers and then vulcanizing or cross-linking the compounded rubber stock. The gum, as described by Gregory (159), is produced commercially in two different ways. Through a direct reaction, methyl chloride and silicone are combined in the presence of copper, as a catalyst, to form a mixture of methyl chloro silanes. This mixture is fractionated to obtain dimethyl dichlorosilane, which in turn is hydrolyzed to produce a silicone oil. This partially condensed methyl silicone oil is then further polymerized to produce the final gum compound. In the Grignard process, silicon tetrachloride, methyl chloride, and magnesium are starting reactants. Through a Grignard reaction a mixture of methyl chlorosilanes is formed, and from this point the procedure can be the same as in the direct process to produce a methyl silicone gum.

Compounded rubber stocks are produced from the gum by mixing on two-roll mills or in the Banbury with such fillers as calcium carbonate, lithopone, titanium dioxide, and various silica fillers. Carbon black has not been used to a great extent in silicone rubber because of vulcanization difficulties [it gases badly at 200° C., according to

Doede and Panagrossi (160), and does not impart high enough tensile strength]. It has not been found possible to vulcanize silicone rubber by means of sulfur or sulfur containing compounds. By the use of certain organic peroxides, however, successful vulcanization is accomplished.

Some of the most recent information on the compounding of silicone rubber has been presented by Glime, Duke, and Doede (161) and Spencer, Davis, and Kilbourne (162). In the first paper 55 pigments and pigment mixtures were investigated both with and without various kinds of surface treatment of the particles. Wetting agents and benzoyl peroxide, as a curing agent, were included in this paper. In the second paper the authors discuss improvements in physical properties of silicone compounds, effect of time and temperature of curing on silicone compounds, the effect of pigment surface, pH and moisture on physical properties, and a new method for simultaneously reinforcing and vulcanizing silicone rubber in the absence of peroxidic agents. The reinforcing properties of silica aerogel, titanium dioxide, pure aluminum oxide, and a new hydrophobic silica in dimethyl silicone elastomer are compared; unusually high tensile strengths and elongations are obtainable with aluminum oxide and hydrophobic silica.

After the silicone rubber stock has been fabricated into finished parts either by molding or extrusion, a bake cycle of from 50 to 60 hours at 200° C. is necessary to bring out optimum properties. Silicone rubber is processed on standard rubber equipment. It may be extruded in a standard continuous extrusion machine and molded and vulcanized in a steamheated press.

The properties of silicone rubber depend to a large extent on the type of reinforcing filler and degree of vulcanization. These, according to Marsden (163), are: heat resistance—silicone rubber, compared to other rubbers, is in a class by itself; low-temperature characteristics—silicone rubber retains flexibility at lower temperature than other known rubber-like materials; hardness—the slight change in hardness and flexibility of silicone rubber over the temperature range of —55° F. to 572° F. is duplicated by no other elastomeric materials; according to Doede and Panagrossi (160), its high-temperature resistance appears due to the strength of the Si-O-Si backbone; tensile strength—the tensile strength of silicone rubber is lower than that of most other rubbers; chemical resistance—the rubber deteriorates rather rapidly in contact with strong acids and alkali, hydrocarbons cause considerable swelling; non-corrosive properties—this rubber in contact with metals has no corrosive action because of its chemical inertness and because it contains no added ingredients such as sulfur-containing vulcanizing agents which cause corrosion; adhesive properties—when metal inserts are molded in a silicone rubber article, relatively little sticking of the rubber to the metal occurs; electrical properties—the electrical data for silicone rubber indicate its usefulness as electrical insulation over a wide frequency range; ozone and corona resistance—silicone rubber is highly resistant to ozone and corona conditions; silicone rubber is odorless, tasteless, and non-toxic.

Silicone rubber is in no way a substitute material or just another elastomer. Its properties of thermal stability, as pointed out by Servais (164), offer a brand-new product and a new range of temperature conditions where elasticity can be obtained. Its flexibility range of from —70° F. to 500° F., its resistance to oxidation, excellent heat aging, low compression set, and good electrical properties are factors that can be put to use in a variety of applications.

Silicone rubber is used in any application where rubber-like properties are required at temperatures either above or below the serviceable limits of organic rubber, or where maximum resistance to oxidation and other forms of deterioration are necessary, or where good electrical insulating properties must be maintained under adverse conditions. The properties of silicone rubber are put to use in packings, and in gaskets, as pointed out by Servais (165).

The demand for silicone elastomers has come from practically all industries interested in heat resistant materials (166).

"Hypalon"

"Hypalon"[4] is, according to Warner (167), a new chlorosulfonated polyethylene obtained by treating polyethylene resin with chlorine and sulfur dioxide. It contains 27.5% chlorine and 1.5% sulfur and is supplied as a white spongy matted compound that can be processed much like ordinary rubbers. Its cured products, as pointed out by Brooks, Strain, and McAlevy (168), combine complete resistance to ozone, sunlight, and weather; heat resistance up to 250° F.; low-temperature flexibility down to —65° F.; and outstanding resistance to abrasion. "Hypalon" has unusually good flex life and resistance to crack growth, high hysteresis properties, and low water absorption.

Chlorosulfonated polyethylene, according to Currin (169), offers exceptional resistance to chemical and solvent action, to the effects of oxidizing agents and to absorption of liquids. The complete chemical saturation of chlorosulfonated polyethylene along with its chlorine content has given a polymer demonstrated to have outstanding resistance to ozone and oxygen. Because of this resistance, the elastomer is expected to be relatively inert to most chemical attack.

"Hypalon" can, according to Smook, Roche, Clark, and Youngquist (170) and Busse and Smook (171), be vulcanized with magnesia, litharge, tribasic lead maleate, sulfur type-accelerator Tetrone A, MBT, DPG and organic acids, Stabilite resin, and wood rosin. By virtue of its chemical stability, chlorosulfonated polyethylene has, according to Remington (172), also proved to have good resistance to degradation during aging at elevated temperatures. Outstanding heat resistance is obtained by the addition of selected antioxidants. The heat degradation of vulcanizates cured with litharge is characterized by a loss of tensile strength and elongation, but the initial hardness and stiffness values remain substantially unaffected. Vulcanizates cured with magnesia are superior to those cured with litharge in tensile strength both before and after heat aging, but aging is characterized by an increase in hardness and stiffness values. The best overall resistance to heat degradation was obtained by curing chlorosulfonated polyethylene with a mixture of litharge and magnesia.

These uses of "Hypalon" are said to include tire tread stocks, automotive weather stripping and window channels, coated fabrics, wire and cable covering, footwear, protective coatings for rubber, and many other products. "Hypalon" is also suggested for butyl inner tubes to reduce "growth," in white tire sidewalls, in hose and belting, and wide application in the mechanical goods field. "Hypalon" is unique among elastomers in that it does not require carbon black for reinforcement; therefore, "Hypalon" compounds can be fabricated without color limitations. "Hypalon," as pointed out by Stockfleth (173), is very compatible with other polymers and can be blended with natural rubber, neoprene, butyl,

(*Continued on page 350*)

[4] "Hypalon" is a registered trade mark of E. I. du Pont de Nemours & Co., Inc.

Chlorosulfonated Polyethylene[1]—III

Organic Curing Agents[2]

W. F. Busse[3] and M. A. Smook[3]

THE information given in the preceding two papers on the cure of "Hypalon" chlorosulphonated polyethylene has been based on metal oxide curing systems. Although this polymer is normally cured through the formation of salt bridges between sulfonyl chloride groups on adjacent chains, the material may also be cured by other reactions and through other groups. This paper discusses a few of these cures.

Sulfonyl chloride groups are known to react readily with amines, alcohols, mercaptans, and a variety of bases and other groups. Any polyfunctional compound containing these groups would be expected to be a potential cross-linking agent for chlorosulfonated polyethylene. Equation 1 shows a typical curing reaction with a diamine to form a disulfonamide.

$$2\ RSO_2Cl + H_2NR'NH_2 \longrightarrow R-\overset{O}{\underset{O}{\overset{\|}{\underset{\|}{S}}}}-\overset{H}{N}-R'-\overset{H}{N}-\overset{O}{\underset{O}{\overset{\|}{\underset{\|}{S}}}}-R+2HCl \qquad \text{(Eq. 1)}$$

In addition to the sulfonyl chloride groups there are other possible reactive sites in the molecules. Chain chlorine atoms, particularly if they are substituted in the tertiary position, or are adjacent or near sulfonyl chloride groups, are potentially reactive enough to take part in cross-linking reactions.

The loss of hydrogen chloride from the chain or the simultaneous loss of sulfur dioxide and hydrogen chloride from sulfonyl chloride groups produces unsaturation, which gives other potential curing sites. These may react as they do in natural rubber or GR-S and probably explain why sulfur or compounds containing active sulfur improve the properties of metal oxide cures. There is also the possibility of having the SO_2Cl groups (and Cl groups) properly spaced to give active methylene groups that might undergo cross-linking reactions. With all these reactive groups in chlorosulfonated polyethylene, a wide variety of materials might be expected to have curing activity.

Since the sulfonamide linkage is fairly stable, the use of a diamine might well give a practical curing system; so this reaction was studied first. In initial tests several diamines were incorporated into chlorosulfonated polyethylene on the mill. When an aliphatic diamine, such as ethylene diamine, is added to the polymer, the reaction is so fast that the stock immediately scorches and flakes off the rolls. Aromatic diamines react slower; so it is possible to mill them into a stock without difficulty and cure it in the regular way. However such tests of curing agents, which involve milling and curing solid compounds are, at best, relatively slow and inefficient, and they cannot be used for very rapid cures.

A much more rapid method was needed to screen the many potential curing agents for chlorosulfonated polyethylene and to evaluate their order of reactivity. The Mooney plasticity test, which measures the melt viscosity of the elastometer, is very sensitive to the changes occurring in the initial stages of vulcanization and might be used as a screening test, but this is still relatively slow.

Gelation Method for Measuring Curing Activity

A much faster and more sensitive test may be made by dissolving the elastomer in a solvent, adding the curing agent, heating, and noting changes in viscosity or the gel formation due to the cross-linking agent. The addition of solvent greatly reduces the possibility of getting physical or mechanical cross-linking due to Van der Waals' forces.

It may be noted that the tensile strength of solid chlorosulfonated polyethylene changes from about 300 psi. to 3,000 psi., or about tenfold, during cure. The viscosity or consistency, on the other hand, changes several thousand-fold between the uncured solution and the final solid gel of cured elastomer. Hence very rapid and even crude measures of changes in consistency can give a sensitive measure of the rate of cure. Since the consistency tests are non-destructive, it is also possible to examine a single sample after it has had many successive cures covering a wide range of times and temperatures. By varying the cure from a few seconds at room temperature to several hours at 175° C. or higher, it is possible to compare curing reactions having over a million-fold range of rates.

While a gelatin test, such as this, is a very powerful and rapid screening test, it does not tell the whole story. It should be supplemented by conventional curing tests on solid compositions to get the fine points of the reactions, since the effects of oxygen, solvents, stoichiometry, etc., may be slightly different in solution than in the solid cures. Also, the gel test is more sensitive to the first cross-links formed, and unless rather precise quantitative measures of gel strength are used, differences in gel structure are difficult to evaluate.

The gelation test used to screen curing agents for chlorosulfonated polyethylene was run as follows: Fifteen cubic centimeters of a 15% solution of polymer in tetrahydronaphthalene were placed in a test tube and mixed with a gram of the chemical which was to be tested for curing activity. The consistency of the solution was observed by noting the flow when the tube was tipped, or, if a gel had formed, by pushing a stirring rod into it. A rating scale of one to eight was used; one was the original solution, and eight, a stiff gel. The wide range of consistencies observed made this rough classification system adequate. Each solution was examined after standing for various periods of time from one minute to overnight at room temperature, and after successive heating cycles of one hour and three hours at 100, 125, 150, and 175° C. Groups of 20 to 100 samples were tested

[1] Distributed as "Hypalon" chlorosulfonated polyethylene. "Hypalon" is a registered trade mark of E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

[2] Presented before the Division of Rubber Chemistry, A. C. S., Cincinnati, O., Apr. 30, 1952.

[3] Polychemicals Department, du Pont Experimental Station, Wilmington.

simultaneously, yielding a tremendous amount of information in a short time.

Amines As Curing Agents

When a number of polyamines were evaluated by this gelation technique, the results shown in Table 1 were obtained. The relative rates agree with the reactivity of the diamines established by conventional milling methods. The rates of gelation closely paralleled the relative basicities of the amines involved.

TABLE 1. GELATION TIMES OF CHLOROSULFONATED POLYETHYLENE SOLUTIONS WITH AMINES

	Gelation Conditions	
Amine	Time	Temperature °C.
Tetraethylene pentamine	<1 min.	25
Diethylene triamine	<1 min.	25
Hexamethylene diamine	<1 min.	25
Ethylene diamine	1 min.	25
p-Phenylene diamine	1 hr.	100
Benzidine	5 hrs.	125
Melamine	5 hrs.	150

Some rather interesting variations on this gelation work were made, which help to establish the chemistry of the cross-linking reaction. When a monofunctional primary amine, such as butyl amine, was added to the chlorosulfonated polyethylene solution, followed by the aliphatic diamine, no gelation was observed at room temperature or at slightly elevated temperatures. This fact is easily explained by the formation of monosulfonamides, which prevent the cross-linking with bifunctional amines.

If the solution is then heated above 150° C., gelation ultimately occurs. This cross-linking is postulated to take place through reaction of chain chlorines with the diamine to yield disecondary diamine linkages. To check this theory, chlorinated polyethylene containing 30-35% chlorine, but no sulfonyl chloride groups, was treated with ethylene diamine. No gel was formed at first, but when this solution was heated to 150-175° C., it was found to give a gel. It is, therefore, obvious that chain chlorine atoms can and do enter into this curing reaction at higher temperatures.

The action of several other amino compounds in chlorosulfonated polyethylene solutions is also worthy of note. Ethanolamine reacts quite rapidly at room temperature to give a very stiff, solid gel. This gel, however, is thermoplastic, and at about 70-80° C. melts back to a free-flowing liquid. The melting and regelling are reversible. Ethanolamine may be added slowly on the mill, and the resulting compound may be pressed under mild molding conditions to give a material which appears to be cured. Its properties are shown in Table 2.

Another class of compounds which give rather unexpected results in the gel work is the tertiary amines. In a manner as yet unexplained, a material such as triethylamine will form a stable gel of a chlorosulfonated polyethylene solution within a few minutes at room temperature.

Secondary amines, including diethylamine, dipropylamine, and dibutylamine also had some gelling activity. Less basic amines, such as pyridine and quinoline, were unreactive. Several quaternary ammonium compounds including tetramethyl ammonium hydroxide and benzyl trimethyl ammonium hydroxide also caused rapid gelation.

Physical gels could be obtained under the right conditions with a primary amine such as n-butylamine. If an exact equivalent of the amine were added to a 15% solution of chlorosulfonated polyethylene, gelation would occur fairly rapidly. This physical gel, unlike those formed with diamines, could be redissolved in excess amine, or would not form at all if a sufficient excess of the amine were added initially. By reducing the elastomer concentration in the solution to about 10%, no gelation occurred with any concentration of the butyl amine.

TABLE 2. CHLOROSULFONATED POLYETHYLENE PRODUCT WITH ETHANOLAMINE

"Hypalon"	100	100
Ethanolamine (pressed 15 min./100° C.)	10	....
Tensile strength, psi	1500	425
% Elongation	350	1300
Permanent set %	20	350
Water absorption (7 days at 70° C.) %	57	32

Polyhydroxy Compound with Bases for Curing

Although glycols and other polyhydroxyl compounds by themselves have no activity in gelling chlorosulfonated polyethylene solutions, these compounds were very active if bases were present. Apparently diester cross-links are formed by the glycols only when acid acceptors are available. The bases used in these studies included organic materials such as primary amines, as well as inorganic bases. When amines were used, it was important that the glycol be added first to obtain gelation. If the opposite order of addition were adopted, sulfonamide formation would take place to the exclusion of the ester. No increase in viscosity was noted in the case where amine was added before the glycol.

Hydroxyl compounds which were found to be efficient gelling agents in the presence of bases included ethylene glycol, sorbitol, glycerol, hydroquinone, and 1,4-butynediol. Weak bases such as aniline, pyridine, and p-phenylene diamine were ineffective in promoting the esterification.

Other Materials As Curing Agents

Other materials which gave positive results in the gelation work at elevated temperatures included some common rubber vulcanizing agents: sulfur, sulfur chloride, thiuram monosulfides and disulfides, and thiocarbamic acid derivatives. Guanidines, thioureas, thiocyanates, and miscellaneous compounds like ammonium sulfide, sodium sulfide, and some soaps all caused gelling. Strong Lewis acids, such as aluminum chloride, ferric chloride, and sulfuric acid gelled the solutions, but also darkened them severely. Table 3 shows the reactivity of some of these materials in gelling chlorosulfonated polyethylene solutions.

TABLE 3. VISCOSITY CHANGES WITH TYPICAL REAGENTS

	One Hour		Three Hours		
Successive heating cycles—° C.:	25	100	125	150	175
Ethylene diamine	8	8	8	8	8
Urea	1	1	1	6	8
Sulfur	1	1	1	6	8
p-Quinone dioxime	1	1	2	8	8
Sodium sulfide	1	5	6	8	8
Mercaptobenzothiazole	1	1	1	6	8
Potassium thiocyanate	1	1	6	6	8
Sulfuric acid	1	3	6	8	8
Ethylene glycol	1	1	1	1	1

Rating scale: 1 = no change
2 = increased viscosity
3 = very viscous liquid
5 = weak gel
6 = medium gel
8 = strong gel

From our solution work we were able to select about eight or ten classes of chemical compounds which gelled chlorosulfonated polyethylene solutions at about the right rate to appear practical for solid cures. Representatives of these classes were then studied by conventional milling and curing techniques. Since reactions involving either the chlorine atoms on the chain or the chlorine atoms from the sulfonyl chloride group yield free hydrogen chloride, some method of tieing up this acid should be provided in evaluating curing agents. The potential cross-

linking agents were evaluated first as the only curing ingredient in a chlorosulfonated polyethylene stock, and then in combination with calcium carbonate as an acid acceptor. In other work carbon black was added instead of the calcium carbonate.

Some of the best vulcanizates were obtained from aromatic diamines such as benzidine, thiourea and its derivatives, aliphatic and cyclic dioximes, thiurams, and thiocarbamates. Tensile data for representataive compounds are shown in Table 4. The presence of calcium carbonate improves the cure obtained with some of the cross-linking reagents. In a few cases carbon black also improved the strength, but as a rule it was not needed to get good properties. Other classes of compounds which showed marked curing activity are shown in Table 5. They include ureas, thioamides, nitroso compounds, guanidines, and substituted thiazoles.

TABLE 4. ORGANIC CURING AGENTS FOR CHLOROSULFONATED POLYETHYLENE

	Properties			
	Gum Stock		20 Pts. Calcium Carbonate	
Curing Agent (2) Pts.	Tensile PSI.	% Elongation	Tensile PSI.	% Elongation
Benzidine*	2240	300	2290	340
Thiourea*	1495	325	2365	345
NA 22 (2-mercaptoimidazoline)†	1975	315	2430	380
p-Quinone dioxime (GMF)†	2440	240	1600	450
2-5 Hexanedione dioxime†	2690	385	1960	405
Ethyl zimate (zinc diethyl dithiocarbamate)*	875	585	1710	535

*Cure—10 min./140° C.
†Cure—30 min./160° C.

TABLE 5. SOME COMPOUNDS WITH CURING ACTIVITY

Thiosemicarbazide	2-Mercaptothiazoline
Thioacetanilide	2-Mercaptobenzothiazole
Dithioadipamide	Glutaraldehyde dioxime
Diacetyl ethylene diamine	Urea
1,3,4 Thiodiazole-2, 5-dithiol	Diphenylguanidine
p,p' Diaminodiphenyl methane	S-Diphenyl thiourea
p-Phenylene diamine	Dicyandiamide
2-Aminobenzothiazole	Diphenyl thiocarbazone
Dipentamethylenethiuram tetrasulfide	Dithiobiuret
Ammonium thiocyanate	Biuret
Sodium p-nitroso phenol	N,N' Dithio-bis-morpholine
p-Dinitroso benzene	Benzothiazyl disulfide
2-Aminobenzenethiol	

Organic vs Metal Oxide Curing Agents

While the chemical reactions that occur in these cures may be quite different and are far from being completely understood, most of these cures have several things in common. The stocks usually are softer and have a lower modulus than compounds cured with a metal oxide. Oven aging of the compositions is good, and complete ozone resistance is maintained regardless of the curing system used. However, if the hydrogen chloride evolved during the cure is not tied up in an insoluble compound, the cured sample will be sensitive to water. Calcium carbonate acts as an efficient acid scavenger, but it does not yield an insoluble chloride. In all the cases examined the addition of carbonate to a compound increased the rate of water pick-up. The susceptibility of compositions to swelling in water, however, was largely determined by the curing agent used. It varied from 0.75% for benzidine to 512% for urea, when films 40 mils thick were immersed seven days at 70° C.

While the aliphatic diamines cure chlorosulfonated polyethylene much too rapidly to be added on the mill, they make possible other methods of curing. Thin films, for example, can be cured rapidly through introducing the diamine by a diffusion process.

Summary

A practical gel test for screening potential curing agents has been demonstrated. In a very short time the order of reactivity and an indication of ultimate strength to be obtained from a curing system can be determined.

A number of organic curing agents for chlorosulfonated polythene has been found. Some of them appear to react in a quite straight-forward way; while others may involve reactions at least as complex as those occurring in cures of natural rubber. Many of the organic curing agents give products comparable to those obtained with metal oxide cures. Others give novel properties, or make possible novel methods of cure.

Compounding Research

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GR-S, and acrylonitrile rubbers. Certain improvements can be imparted to various other elastomers by blending with "Hypalon."

An example of a half replicate factorial design used in exploring the cure system of a blend of chlorosulfonated polyethylene with natural rubber is presented by Gore (174). In this example the number of experiments was reduced from 54 in the original plan to eight in the half replicate factorial.

The reactions of chlorosulfonated polyethylene with amines, alcohols, and inorganic bases have been followed by Smook, Pieski, and Hammer (175) by means of infrared. These workers demonstrated the sensitivity of the molecule to water during these reactions; they also showed the effect of heat on the stability of the sulfonyl chloride group.

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(Concluded on page 353)

[5] Trade mark of Dow Corning Corp.

Creep of Neoprene in Shear Under Static Conditions: Ten Years[1]

W. Newlin Keen[2]

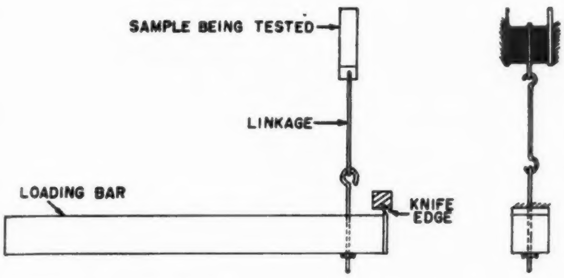

Fig. 1. Schematic Sketch of Test Specimen, Loading Bar and Linkage

In 1945 the author presented a paper[3] showing the results of static creep tests conducted at room temperature and extending over a period of three years and nine months. That report shows how the creep in shear of neoprene vulcanizates in the hardness range of 40 to 60 durometer (Shore Type A) is influenced by: (1) degree of vulcanization; (2) preconditioning in shear at elevated temperatures; (3) change in composition. These tests have been continued, and this paper presents the results obtained over a period of nearly 11 years. The effect of natural aging for this period of time on some of the mechanical properties of the vulcanizates is also included. The study has been extended for some of the vulcanizates to include the effect of changes in test temperature.

Method of Testing

The test method described in the original paper is briefly summarized here. Yerzley shear specimens (ASTM D945)[4] were tested under a constant stress of 17.75 psi. and at a controlled temperature of 82 ± 2° F. (In 1948 the temperature of the physical testing room was reduced to 75 ± 2° F). Figure 1 is a schematic sketch showing the details of the loading bar with its knife-edge construction and adjustable linkage so that the bar can be leveled as creep takes place in the specimen. Creep in inches is measured by a dial gage (0.001-inch) equipped with a special jig. The data from the long-time creep test are expressed in terms of % relative creep.

$$\%\ \text{Relative Creep} = \frac{\text{Total Deformation} - \text{Initial Deformation}}{\text{Initial Deformation}} \times 100$$

Initial deformation is defined as the deformation obtained five minutes after loading.

In the original paper the creep data were plotted using log-log coordinates. The effect of such coordinates in condensing the time scale makes it difficult properly to assess the value of tests in which the important variable is the length of time of the testing period. Therefore the long-time creep data are plotted as % relative creep *versus* time, using rectangular coordinates.

Figure 2 shows the influence of the degree of vulcanization on the static creep characteristics of a neoprene composition. It will be noted that each of the

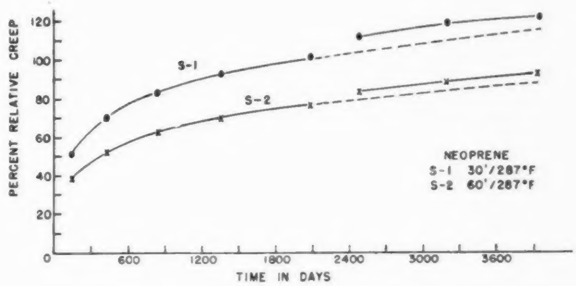

Fig. 2. Influence of Cure on Creep of Neoprene

curves shows a discontinuity between 2,100 and 2,400 days. In view of all of the data collected in this study, it is believed that this break in the curve was caused by an external disturbance of the specimen and not by the shearing stress. Therefore the original curve is continued as a broken line to indicate the probable % relative creep which would have been obtained had no outside disturbance occurred. As the degree or state of vulcanization is increased (S-1 *versus* S-2), the rate and the magnitude of the % relative creep are decreased. This point confirms the conclusions drawn in the original paper. These curves clearly indicate the importance of curing neoprene to a high state of vulcanization for applications requiring low creep.

Preconditioning to Reduce Creep

Another way to reduce the creep of some vulcanizates is preconditioning. Preconditioning of the neoprene (S-3D) and the natural rubber (S-7D) specimens (Figure 3) consisted of straining them 30% in shear and

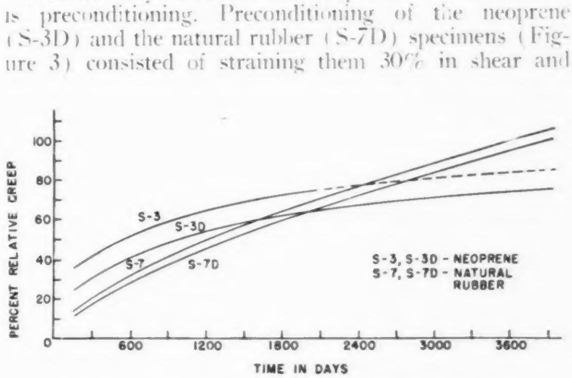

Fig. 3. Influence of Preconditioning on Creep of Neoprene

[1] Presented before the Rubber & Plastics Division, ASME, New York, N. Y., Dec. 4, 1952. Contribution No. 94, rubber chemicals division, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

[2] Du Pont rubber chemicals division.

[3] "Creep of Neoprene in Shear under Static Conditions," *Trans. Am. Soc. Mech. Engrs.*, Apr., 1946, p. 237.

[4] "ASTM Standards on Rubber Products," prepared by ASTM Committee D-11, American Society for Testing Materials, 1916 Race St., Philadelphia, Pa.

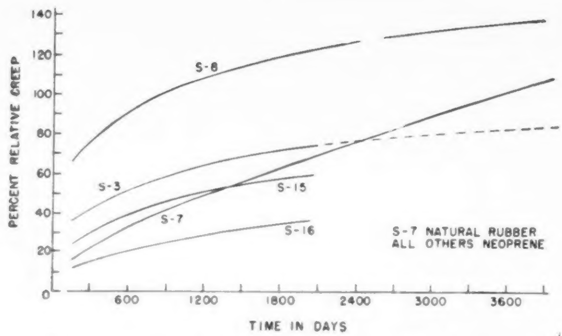

Fig. 4. Influence of Composition on Creep of Neoprene

heating them in this condition for 24 hours at 158° F. After the heating period the specimens were removed from the jig and permitted to rest for one week at 82° F. before being mounted on the static creep test stand. Figure 3 indicates that this type of preconditioning reduced the magnitude of the creep for both neoprene and natural rubber vulcanizates. For the particular vulcanizates studied, the effect of preconditioning is considerably greater for the neoprene than for the natural rubber stock. It would appear that preconditioning offers some possibilities in developing products having maximum resistance to creep.

Effect of Changing Composition

The rubber technologist has two methods of changing the composition of his products. One consists of using different elastomers, and the other of using different compounding materials. Table 1 classifies according to ASTM D735[4] (SAE-10R)[5] compositions which have been varied by both of these methods. The data plotted in Figure 4 shows the effect of some of these changes in composition on the creep characteristics of the vulcanizates. The most startling variation due to composition is shown when one considers the latter portion of the curves. Beyond approximately 1,200 days, the rate of change of relative creep is much less for all of the neoprene stocks studied than it is for the rubber control (S-7). In fact, this difference is so pronounced that the final values of the % relative creep of the rubber stock exceed that of both S-3 and S-15, although in the earlier stages of these tests its % relative creep was lower. The numerical values for creep at the end of 10 years and nine months are given in Table 3. S-16 represents a change in the type of neoprene used; whereas stocks S-3, S-8 and S-15 represent compounding changes with the same neoprene. (The data on S-8 may be influenced by a lower state of vulcanization that exists in the other neoprene stocks.) It will be noted from Table 1 that stock S-16 has a very low compression set, and this, coupled with its excellent resistance to creep, will undoubtedly make this type of composition of greatest interest to the design engineer.

TABLE 1. IDENTIFICATION OF COMPOUNDS

Specimen	ASTM (D 735) Grade No.	Cure Min./°F.	Hardness Shore A	% Set, ASTM Method B
S-1	SC-425	30/287	44	39
S-2	SC-525	60/287	46	25
S-3	SC-525	30/307	47	24
S-7	RN-530	15/287	46	24
S-8	SC-614	40/307	59	32
S-11	RN-540	25/287	50	19
S-12	SC-535	25/307	48	9
S-13	SC-530	25/307	51	10
S-14	SC-540	25/307	55	25
S-15	SC-425	45/307	43	16
S-16	SC-530	45/307	46	7

[5] Rubber and Synthetic-Rubber Compounds for Automotive and Aeronautical Applications, pp. 243-249, "SAE Handbook 1952," Society of Automotive Engineers, Inc., 29 W. 39th St., New York, N. Y.

Effect of Age on Properties

Engineers are always interested in learning how age affects the materials with which they are working. Unfortunately, the amount of data available on long-time natural aging is very limited, and in general both the engineers and the rubber technologists must draw their conclusions from accelerated aging tests. Since the creep tests represented in this paper extended over a period of 10 years and nine months, they afford an excellent opportunity of ascertaining the effect of this period of natural aging on the mechanical properties of the vulcanizates. These data are summarized in Table 2, which is similar in form to Table 2 in the earlier paper. This table shows the original mechanical properties of the shear specimens; how these properties changed while the samples were on the creep test stand; and how these properties changed in specimens of the same vulcanizates stored in an unstressed condition for the same period of time. The data indicate that all the vulcanizates tested have such excellent resistance to natural aging that changes due to this cause would have little bearing on their utility. This conclusion appears to be valid for both the specimens aged under stress and those aged in an unstressed condition. The compression characteristics of some of these vulcanizates are given in the earlier paper.

TABLE 2. EFFECT OF NATURAL AGING ON MECHANICAL PROPERTIES

Specimen	Resilience, % at 20% Deformation	Frequency Cycles/Min.	Static Modulus, PSI. at 5% Deformation	Static Modulus, PSI. at 20% Deformation	Stress PSI. at 20% Deformation	Effective Dynamic Modulus, PSI.
Shear Characteristics—Original						
S-1	85	167	100	106	20	116
S-2	86	169	120	107	22	119
S-3	87	176	115	105	22	129
S-7	90	161	121	125	25	131
S-8	80	202	150	145	30	206
S-11	87	150	87	80	18	94
S-12	80	169	103	92	21	118
S-13	81	175	115	103	22	128
S-14	84	175	148	132	29	156
S-15	89	163	114	106	23	110
S-16	84	159	102	100	21	102
Shear Characteristics after a 10-Year and 9-Month Static Creep Test						
S-1	88	170	125	120	26	134
S-2	88	172	130	125	26	136
S-3	87	172	125	125	26	136
S-7	84	173	125	120	26	138
Shear Characteristics after 10 Years and 9 Months' Aging in an Unstressed Condition						
S-1	90	170	140	125	26	133
S-2	89	170	140	125	25	133
S-3	90	170	125	120	26	133
S-7	85	173	125	125	27	138

Effect of Test Temperature

With the increasing use of elastomers in the automotive and aeronautical fields, a study of the effect of the temperature at which the product must operate has become increasingly important. Since elastomeric springs or mountings are subjected to various temperatures in

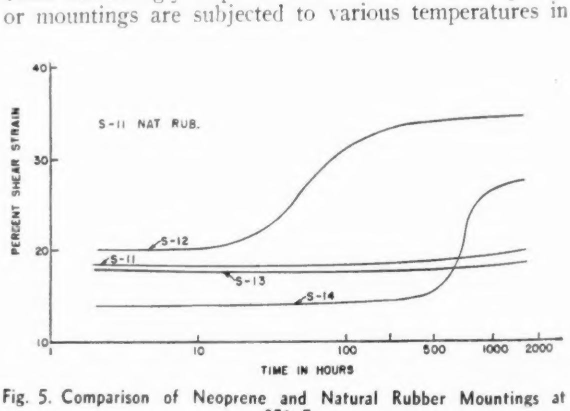

Fig. 5. Comparison of Neoprene and Natural Rubber Mountings at 32° F.

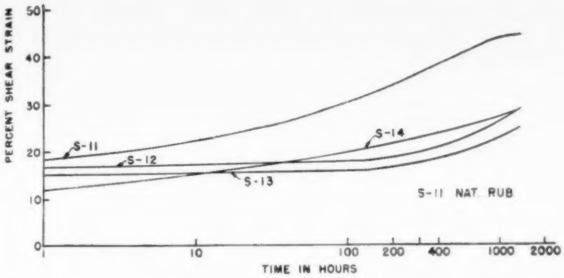

Fig. 6. Comparison of Neoprene and Natural Rubber Mountings At 200° F.

service, creep tests were conducted at 32 and 200° F. under the same stress (17.75 psi.) as the room temperature tests.

TABLE 3. STATIC CREEP CHARACTERISTICS IN SHEAR (UNDER STRESS OF 17.75 PSI.)

Specimen	Initial Deformation, In. (5 Min.)	10 Years and 9 Months: Creep, In.	10 Years and 9 Months: % Relative Creep
S-1	0.0930	0.1128	121.1 (115)*
S-2	0.0858	0.0847	98.7 (87)*
S-3	0.0883	0.0840	95.2 (84)*
S-7	0.0707	0.0760	107.5
S-8	0.0591	0.0809	136.9
		5 Years and 7 Months	
S-15	0.0761	0.0420	55.2
S-16	0.0853	0.0312	36.6
		3200 Hours at 32° F.	
	Initial Deformation, In. (2 Hr. at 32° F.)	Final Deformation, In.	Shear Strain, %
S-11	0.0925	0.0980	19.6
S-12	0.1050	0.1710	34.2
S-13	0.0840	0.0945	18.9
S-14	0.0700	0.1390	27.8
		1416 Hours at 200° F.	
	Initial Deformation, In. (2 Hr. at 200° F.)	Final Deformation, In.	Shear Strain, %
S-11	0.0965	0.2212	44.2
S-12	0.0820	0.1424	28.5
S-13	0.0739	0.1240	24.8
S-14	0.0619	0.1441	28.8

*Values from curves.

The results of these tests are plotted as change in % shear strain *versus* time in hours on semi-log coordinates. These data are plotted as change in % shear strain instead of % relative creep because of the thermoelastic characteristics of elastomers and the relative long time (one hour) required for the specimen to reach temperature equilibrium. From Figure 5 it will be noted that two of the neoprene specimens (S-12 and S-14) show a delayed strain relaxation, which has been previously reported by Morris and James.[6] The third neoprene specimen (S-13) does not show this effect. It not only has less shear strain than the rubber control, but maintains this advantage throughout the duration of the test —3,200 hours. The effect shown in S-12 and S-14 is primarily the result of crystallization of the vulcanizates. Crystallization is a reversible process, and the vulcanizate returns to its original state when heated to slightly above room temperature either by changing the ambient temperature or by mechanical working of the vulcanizate. The specimen S-13 is based upon a type of neoprene designed to be extremely resistant to crystallization. Figure 6 shows the creep characteristics or strain relaxation of these same compounds at 200° F. It is interesting to note that natural rubber exhibits higher creep or greater strain relaxation at 200° F. than any of the neoprene specimens. Neoprene mountings represented by S-13 will undoubtedly be of greatest interest to the design engineer because of the outstanding performance of these mountings over a wide temperature range (32 to 200° F.). The room temperature creep characteristics of this vulcanizate will be equivalent to or better than those of specimen S-16 (Figure 4).

[6] "Behavior of Neoprene Vibration Isolators at Various Temperatures." *Rubber Age* (N. Y.), Aug., 1952, p. 625.

Summary and Conclusions

In summary, the data clearly indicate that neoprene vulcanizates can be designed to have resistance to creep equal to or better than that of natural rubber. Neoprene specimen S-13 shows outstanding performance over a range of temperatures. These facts, coupled with the well-known excellent resistance of neoprene vulcanizates to oil, heat, ozone, and natural aging should enhance the value of this material in the eyes of the design and application engineer.

The author takes pleasure in acknowledging the important contributions of A. M. Neal, of the du Pont rubber chemicals division, to the progress of this work. The author is also indebted to M. A. Gass, who made most of the measurements.

Compounding Research

(*Concluded from page 350*)

RUBBER WORLD, Mar., 1953, p. 791.
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(*To be continued*)

Pneumosilicosis

(*Continued from page 344*)

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(4) A. Policard, C. Marrion, "Siliceous Infiltration of the Lungs among Subjects Living in the Sahara Desert." *J. Ind. Hyg.*, July, 1934, p. 160.
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Editorials

Is the Planning for the New Government-Rubber Industry Relations Adequate?

MANY changes are due to take place in the relations between the government and the rubber industry during the next few weeks and months, and there is some reason to believe that what the industry wants from government and *vice versa* in the future is not completely understood by either party.

Legislation for the disposal of the government's synthetic rubber plants to private industry should be enacted by July 1, and the actual disposal should be accomplished within six to nine months. The Rubber Act of 1950, as amended, continues the government's authority for the control of rubber production and consumption until April 1, 1954, but the Rubber Division of the National Production Authority revoked the last controls over rubber consumption on May 8, and that agency is expected to go out of existence on June 30, 1953. Synthetic rubber production by the government will continue at least until April 1, 1954, unless disposal is accomplished before that time. Except for such purchases of natural rubber as are required for rotation of stocks in the strategic stockpile, the government has been inactive in this field since July 1, 1952.

All of the above brings to mind the point raised in our November, 1952, editorial entitled, "What Will Be the Future Role of the Government to the Rubber Industry?" As pointed out at that time, the Federal Government has been in the rubber business for about 10 years, and throughout that period many new services to industry have been provided, but many old services have gradually disappeared. It was added that there is more than just the problem of the disposal of the synthetic rubber plants to private industry; there is the future of the government's research program on synthetic rubber, the extent of business and statistical service to industry, and just what the industry wants from government and *vice versa*.

A recent incident in Congress demonstrates how essential services to all industry may be eliminated if businessmen are not constantly alert to happenings in Washington. The House of Representatives on May 5 sustained the action of its Appropriations Committee in denying funds requested to conduct the 1953 Censuses of Business, Manufacturers, Transportation and Mineral Industries. This action was protested by the Business Advisory Council of the Commerce Department, acting for all industry, and The Rubber Manufacturers Association, Inc., acting for the rubber industry. As a result, it appears that the Senate might act to restore the funds necessary for these censuses, but that the House will allow the cut to stand and then allow it to be replaced later by a deficiency appropriation.

The RMA, in its protest, stated that "the Census of Manufacturers has been a useful and necessary tool in business planning for many segments of the rubber manufacturing industry over a period of many years," and that "the first such Census was conducted in 1810."

James C. Worthy, Assistant Secretary of Commerce for Administration, in a talk before the annual meeting of the Silk & Rayon Printers & Dyers Association in New York, N. Y., May 21, stated that the Commerce Department is reshaping its policy to become an even greater service organization for business. Current plans call for the establishment of a new industry advisory committee that will meet periodically with the Secretary of Commerce and his associates to discuss governmental policies and operations and to present recommendations. It is also hoped to recruit for division industry staffs top executives on a rotating basis who will serve without compensation.

Implementation of the above policy, and as soon as possible, is of particular importance to the rubber industry. During and following the disposal of the synthetic rubber plants there will be a continuing need of policy decisions at high levels. A certain amount of research on rubber by the government in those areas where problems of major strategic importance remain to be solved will be continued, and the direction of this research will profit by consultation and advice from industry.

The Rubber Division of the NPA is meeting with its Industry Advisory Committee on June 2. Among the matters to be discussed will be the continuation of the statistical services to the industry by the Commerce Department. In view of the above-mentioned action of the House Appropriations Committee in denying funds for the Census of Manufacturers, some difficulty may be experienced with Congress in continuing these statistical services. A reasonable compromise should be arrived at, however, with certain services continued by government and the remainder supplied by the industry through its trade association.

P. W. Litchfield, chairman of the board, Goodyear Tire & Rubber Co., recently stated with reference to the transfer of synthetic plants that he had every reason to believe that the government and private industry would work in patriotic and intelligent harmony in this transfer. He added, however, that the mechanics of integrating the feed-stock plants and the copolymerization plants in private hands will be complicated and difficult.

"Now is the time to do the planning which will carry us over these rough spots if they should develop," Litchfield concluded.

It is time to do the planning for all phases of the new government-rubber industry relations.

R. G. Seaman

DEPARTMENT OF
PLASTICS TECHNOLOGY

Stress Crazing of Plastics[1]

J. A. Sauer[2] and C. C. Hsiao[2]

THE onset of crazing in transparent plastics is an undesirable feature that greatly limits their use in engineering applications. Various factors, such as temperature, time, orientation, environment, etc., have an influence on the initiation of crazing, but local stress intensity is probably more directly responsible for its occurrence and subsequent propagation than any other factor. The present investigation will therefore be concerned largely with this aspect, although the effect of other variables will be briefly reviewed. Considerable information concerning the cause of crazing and its influence on subsequent behavior has been reported recently in the scientific literature (1, 2, 3, 4).[3]

Crazing in plastics has been defined as visible mechanical cracks (2), or as submicroscopic failures that result in a noticeable "blushing" of an otherwise transparent material (4). The term "crazing" has also been used to refer to a type of cracking produced randomly on the surface of unstretched rubber by light in the presence of ozone (5). This phenomenon, however, has also been referred to by other terms such as "sun-cracking," "atmospheric-cracking," "ozone-cracking," or "exposure-cracking." Newton (6), for example, has described as "exposure-cracking" the fissures formed in the surface of rubber at right angles to the direction of applied stress.

In the field of metallurgy, a closely related phenomenon to crazing is the cracking of metals or alloys when stressed under certain conditions. Stress-corrosion cracking of metals and alloys and season-cracking of non-ferrous metals, both of which have been intensively studied, are somewhat similar phenomena to crazing in that failure seems to be related to applied or induced stress. In metals, it is well known that cracks or fissures may be produced by rapid changes in temperature, and these faults are believed due to development of induced thermal stresses. Cracks or local fissures can also be produced in rubber by ozone, but the phenomenon is greatly accentuated by the presence of an applied stress system.

In all instances where crazing cracks are caused by direct action of an applied stress system, the crazing cracks formed are at right angles to the maximum tensile stress direction. When stress is not directly applied, randomly directed crazing patterns can be produced and have been reported to occur in thermoplastic materials by solvent action, by X-radiation, and by ultra-violet radiation. In all instances, stress does not seem to be directly involved. However, the possibility of the development of quite large localized internal stresses by any of these processes must not be overlooked. If such internal stresses are great enough to exceed the local failure strength of the material, crazing will result. Crazing patterns produced both by applied stress and indirectly by solvent action have been reported by Russell (2) and by Maxwell and Rahm (7).

The precise mechanism whereby solvents such as kerosene or benzene cause crazing cracks to originate and grow is not yet well established. It is generally thought that the effect depends on absorption of the solvent by the material. Absorption softens the surface and may result either in some of the material reaching a critical elongation sooner or in causing a greater share of stress to be carried by surrounding material, thus tending to produce local fissures, or openings. Another possibility is that as the absorbed solvent evaporates, the surface material will tend to shrink and thereby produce internal tensile stresses sufficient to cause cracks to open up. Regardless of the precise mechanism, the crazing pattern would be expected to differ from that obtained by action of an applied tensile stress in that the cracks or crazing planes should no longer form a regular parallel system, but should be randomly directed. Such, indeed, is the case, as has been shown by Russell for specimens of methyl methacrylate (8).

For a given applied stress magnitude, crazing appears to increase with duration of test (7, 9) and hence with creep elongation. Crazing also increases with increase of temperature. For polystyrene specimens, this effect has been shown by Maxwell and Rahm (7) for various temperatures from 30 to 70° C., for a stress level of 3600 psi. and for various times from five minutes to half an hour.

Crazing in transparent plastics has also been reported (4) to be related to orientation. On a submicroscopic scale it is believed that crazing cracks originate as separations of adjacent regions of polymer chains as a direct result of the applied local force exceeding the secondary attractive forms. It is therefore to be expected that in a highly oriented material subject to applied stress in the direction of orientation, little or no crazing would occur since the applied forces would tend to draw the chains together rather than to separate them. This effect has been experimentally observed by Bailey (10) and Cheatham and Dietz (11). If, however, in the same highly oriented material the stress were applied at right angles to the direction of orientation, then chain separation should occur more easily, and crazing should begin at even lower stress loads.

Dependence of Crazing on Applied Stress

The observation of crazing in specimens subjected to applied loading reveals that the observed crazing cracks generally start on the surface and propagate in a direction

[1] Presented before the Rubber & Plastics Division, American Society of Mechanical Engineers, New York, N. Y., Dec. 5, 1952.
[2] Pennsylvania State College, State College, Pa.
[3] Numbers in parentheses refer to Bibliography items at end of article.

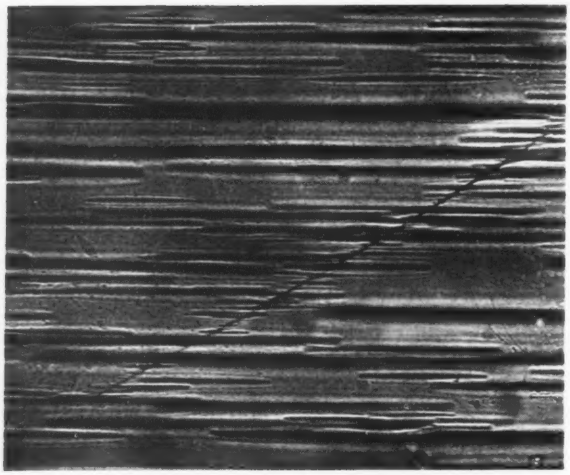

Fig. 1. Micrograph of Crazing Cracks on Molded Surface of Polymethyl Methacrylate (Magnification: X100). (Diagonal Line Is a Surface Scratch)

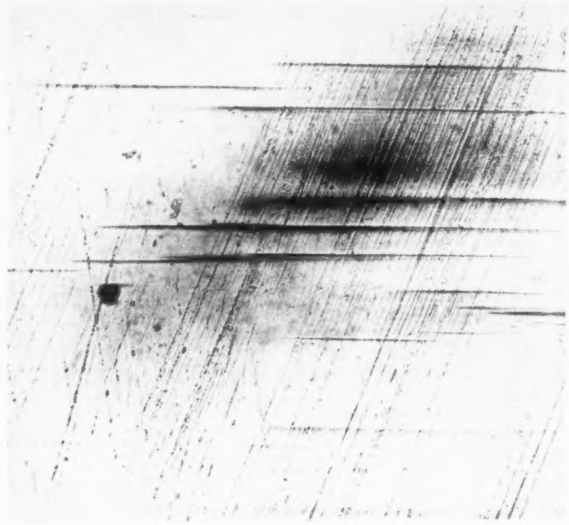

Fig. 2. Micrograph of Crazing Cracks in the Interior of a Polystyrene Specimen (Magnification: X100)

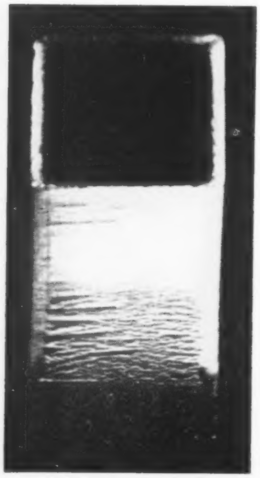

Fig. 3. Crazing Cracks in a Polymethyl Methacrylate Creep Test Specimen

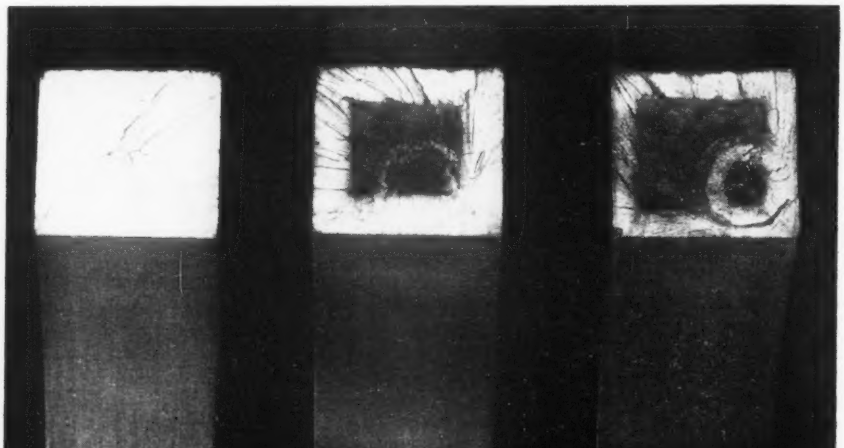

Fig. 4. Crazing Cracks in Polystyrene Creep Test Specimens

perpendicular to the direction of maximum tensile stress. If a transparent plastic specimen is subject to uniaxial tension, crazing planes will develop and grow at right angles to the direction of stressing. These crazing planes appear simply as parallel lines when viewed from their side. A micrograph indicating this behavior for polymethyl methacrylate is shown in Figure 1.

In Figure 1 it will be noted that many crazing cracks originate along the diagonal scratch indicating the favorable effect of stress concentration on the initiation of crazing. Micrographs of a machined polymethyl methacrylate surface show that numerous fine crazing cracks are found to commence along the machine marks. This condition again indicates that crazing is more easily initiated when a local discontinuity in the surface introduces a high stress concentration factor and a resulting local stress considerably higher than the average stress in the specimen. This is what occurs at all outside edges of specimens where surface irregularities are unavoidable; hence we should expect that crazing will usually first occur on the external surfaces.

Figure 2 shows a stress crazing pattern for a section of a polystyrene specimen. The original specimen was ½- by ½-inch in cross-section and subject to a constant tensile stress in its longitudinal direction. The micrograph shown is a transverse view of a longitudinal section taken midway between the vertical surfaces. The inclined lines are polishing marks on the cut surface, and the horizontal lines show the edge of the crazing planes. Some of these crazing planes have originated on the outside surface and have propagated to the interior of the specimen. However, new crazing planes not originating on the surface have evidently also been formed.

If a test specimen is subject to a tensile load which is maintained constant until fracture occurs, then its fracture surface will show crazed regions along the external edges, and non-crazed or amorphous regions in the interior of the specimen. Figure 3 shows such a partially crazed ½- by ½-inch polymethyl methacrylate specimen. The crazing cracks are clearly visible throughout the reduced gage length of the test specimen. The relative amounts of crazed and non-crazed regions depend on the duration of test before fracture occurred.

In Figure 4 are shown stress crazing patterns for several polystyrene specimens with different percentages of crazed and amorphous regions. Two distinct types of

crack patterns are visible: one type is the fracture crack system spreading radially outward from the more or less point source (presumably an internal impurity or flaw) located in the center of the circle on the fracture surface; the second type is the much finer crazing crack system spreading normally inward from the surfaces of the specimen. The depth to which these crazing planes extend and the rate of penetration of these planes depend upon the magnitude of the applied stress as well as on its duration, and appropriate quantitative relations for this variation are given later.

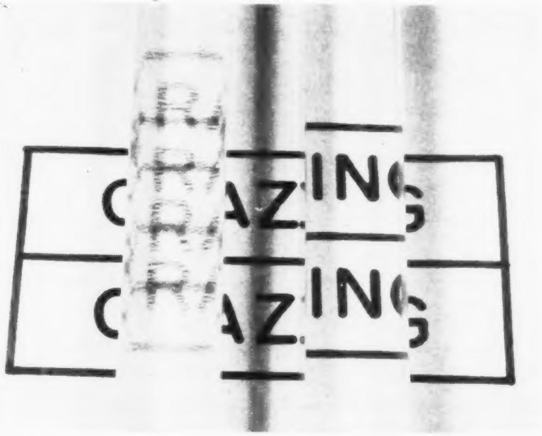

Fig. 5. Effect of Crazing on Optical Distortion Is Shown by Specimen at Left

The qualitative dependence of crazing on stress magnitude and on duration of test is as follows:

For comparable time periods of testing, crazing will increase with increase of applied tensile stress, and for comparable tensile stresses, crazing will increase with increase of time of testing period. Maxwell and Rahm (7) have noted that for thermal clean stress-free specimens of polystyrene no crazing at all, as measured by reflected light intensity, will occur until a tensile strain of 0.75% is reached, but that the amount of crazing would increase rapidly as the strain was increased beyond that value. The variation of crazing with time for specimens subject to constant load has been reported by Maxwell and Rahm (3) to be linear for times up to several hundred minutes. Sauer, Marin, and Hsiao (9) have reported that for polystyrene specimens under high tensile stress loading, fracture occurred shortly after load was applied, with only slight or insignificant amounts of crazing around the edges of the specimen. For lower stress magnitudes these authors reported that for some specimens fracture did not occur until hundreds of hours had elapsed, and that crazing had by then extended over the entire cross-section (as in the left diagram of Figure 4).

It should be emphasized that crazing does not depend only on stress and time, but also on the particular material under investigation. For example, for comparable stress and time as well as surface conditions, crazing cracks in polymethyl methacrylate specimens are usually larger and less dense than those in polystyrene specimens, but at the same time do not extend as far from the surface. These characteristics may be seen by comparison of the stress crazing patterns of Figures 1 and 2 and also Figures 3 and 4.

The effect of crazing on optical distortion can be demonstrated by the double reflection which the crazing cracks produce. This may be seen in Figure 5, where the specimen on the left has been partly crazed as a result of being subject to tensile stress for some time, and the specimen on the right is unstressed. The double image is caused by the separate reflections arising from the crazed areas lying adjacent to the top and bottom surfaces.

A rather interesting observation reported by Sauer, Marin, and Hsiao (9, 4) is that polystyrene specimens may be completely crazed throughout their cross-section and yet continue to carry a considerable amount of load. A large polystyrene specimen (½- by ½-inch in cross-section) was subjected to a constant tensile stress of approximately 3,000 psi. for approximately 1,000 hours. At the end of this time crazing cracks extended throughout the cross-sectional area. From this larger specimen a small round specimen was made and retested in tension. The stress-strain curve of this second smaller specimen together with that of the original material is shown in Figure 6. The data indicate the fully crazed material has approximately the same ductility and somewhat more than one-half the tensile strength of the uncrazed material. There is also shown in Figure 6 a stress-strain curve for a small specimen taken from the non-crazed portion of a larger tensile specimen. It will be noted the strength is about the same, but the initial modulus is perhaps slightly greater than the original material.

It is well known (4) that if a compressive rather than a tensile load is applied to a specimen of a transparent high polymer, no crazing will occur. In view of this point it was thought desirable to investigate whether applied

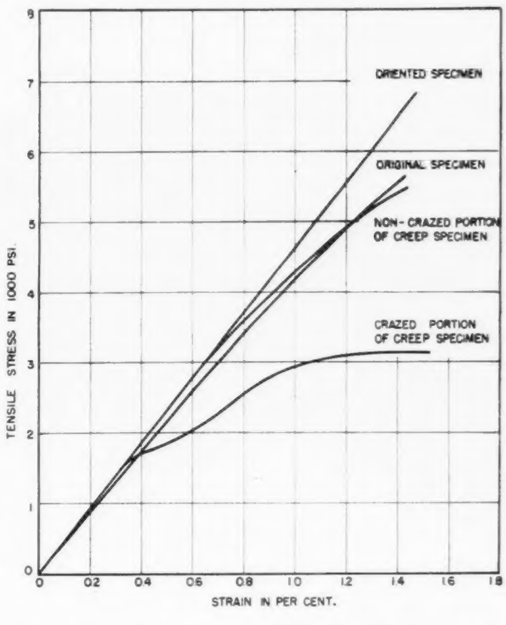

Fig. 6. Stress-Strain Curves of Polystyrene Specimens Tested in Tension

compression would be beneficial in eliminating crazing previously produced by tension. A small test specimen was cut from a large polystyrene specimen previously completely crazed in a tension creep test. The small test specimen was then compressed and released three different times, and finally tested in tension to determine whether any beneficial effects could be noted. The pre-compression seemed to result in a partial healing of the crazing cracks, although some distortion of the crazing planes took place. Probably because of the destructive influence on the parallelism of the crazing planes and the apparent closing up of the openings between the crazing

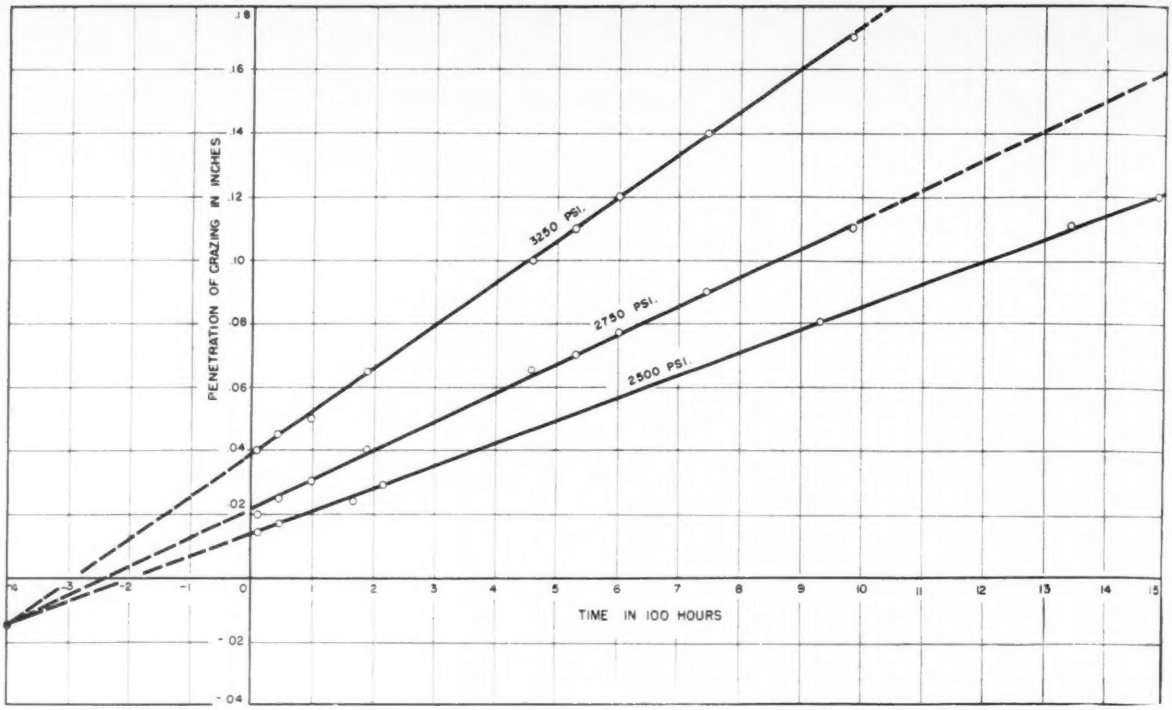

Fig. 7. Penetration of Crazing in Polystyrene under Different Stress Levels

planes, the specimen at this time was quite clear to the naked eye with little visible signs of crazing. However, when viewed under a light microscope, crazing planes could still be seen. Hence applied compression is at best only partly effective in healing crazing openings produced by tension. Also, if the precompressed samples are tested in tension, these original crazing cracks again open, and no increase in strength is observed.

It was stated above that orientation has an effect on crazing. It also has an effect on the stress-strain characteristics and on the ultimate breaking strength. A statistical evaluation of the fracture strength for polymers subject to various amounts of orientation has been made by Hsiao and Sauer, (4) and their predicted values check satisfactorily with the experimental data of Bailey (10) and of Cheatham and Dietz (11).

One example of the effect of orientation on strength can be obtained from a comparison of the graphs in Figure 6 marked "oriented specimen" and "original specimen." The "oriented specimen" was one that had been previously oriented approximately 300% by stretching in each of two biaxial directions. According to the statistical theory of Hsiao (12), its strength should be approximately 26% higher than that of the unoriented samples. The graphs of Figure 6 indicate that the experimental increase is approximately of this order of magnitude.

The particular "oriented specimen," whose stress-strain behavior is shown in Figure 6, is one that was built out of a series of laminated layers of polystyrene—each layer had been biaxially stretch-oriented to the amount mentioned above. The test was conducted at a strain rate of about 50 x 10^{-6} in/in/sec., and the loading continued until fracture occurred. Despite the short duration of the test (4-5 minutes) some crazing occurred and was clearly visible on the fracture surfaces.

Rate of Propagation of Crazing

Under the action of a maintained tensile stress, crazing cracks originate on the external surfaces of the specimen and propagate inward toward the center. To obtain information on the rate of propagation with time, it is necessary to have a continuous measure of the penetration of the crazing front. Since the crazing cracks develop on all four external surfaces of square specimens and thus destroy visual transparency, it is not easy to measure the inward penetration of the crazing cracks until after the specimen has fractured.

Fortunately, this difficulty can be overcome by use of special coatings. As reported by previous investigators (4), crazing can be greatly retarded or even prevented from occurring by applying certain synthetic polymer coatings to the outside surfaces. For polystyrene, one such coating is a solution consisting essentially of styrene monomer. To obtain the desired visual advance of the crazing front, two opposite faces of the specimens are coated and the other two faces left free. On continued application of a constant tensile load, the crazing cracks will then start as usual on the free surfaces and grow inward as time passes. The coated sides, however, will remain essentially craze-free; hence the depth of penetration of the crazing cracks can be easily observed and measured by viewing them from a direction perpendicular to the coated sides.

A plot of the amount of penetration of crazing against time is given in Figure 7 for specimens subject to three different stress levels (3,250, 2,750, and 2,500 psi.). Owing to the fact that polystyrene is rather brittle at ordinary room temperatures, many specimens, especially those at high applied stress levels, failed before any appreciable value of crazing could be recorded. The data indicate that the relation between penetration of crazing and time is a linear one over the stress range investigated.

It is interesting to note that these three long-time crazing curves at different stress levels show different amounts of penetration of crazing at the very start of the test. Usually, sharp cracking sounds could be heard soon after the load was applied, which condition suggests the sudden appearance of crazing and the immediate release

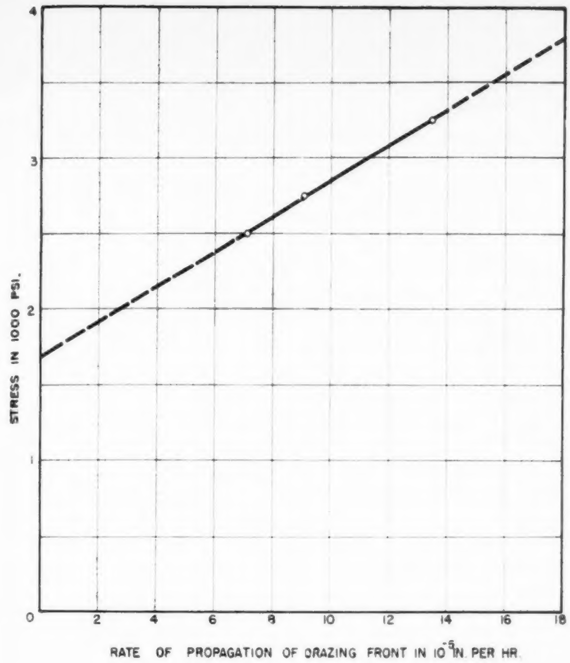

Fig. 8. Effect of Tensile Stress on Rate of Propagation of Crazing in Polystyrene

of a portion of energy into sound waves. If the first derivatives of these curves with respect to time are plotted against magnitude of the corresponding stress level, it appears that the rate of displacement of the crazing front varies linearly with the stress, as shown in Figure 8.

It is unfortunate that more test points are not available, but within the stress limits indicated the rate of crazing varies with the stress in the following manner.

$$\dot{D} = (\sigma - \sigma_0)$$

where σ is the stress is psi

m is the slope of this straight line

$\dot{D}$ is the rate of propagation of crazing front in inches per hour

and σ_0 is a constant measured in stress units.

Since the velocity of crazing is thus a linear function of stress, the depth of crazing can be written by integration as

$$D - D_0 = K(\sigma - \sigma_0)(t - t_0)$$

where D_0 and t_0 are constants, and K=1/m. For polystyrene, D_0 = -0.015-in., K = 0.851 x 10^{-7} in./hr./psi., σ = 1670 psi., and t_0 = -400 hrs.

Thus, within the limited range of stresses, indicated in Figure 8, the depth of crazing may be expressed as a linear function of both stress magnitude and time. It is questionable whether the above equation can be extended to much lower stresses, but its implication that the rate of propagation of crazing goes to zero for some limiting stress value does seem to be in general agreement with experimental results (9). It is also difficult to investigate the above relation for much higher stresses than 3,500 psi., as the specimen tends to fracture in much shorter time periods, and thus not much data on crazing can be taken.

As shown in Figure 9, such short-time fractures are frequently caused by obvious flaws which result in high local stress intensities. The actual fracture cracks, as distinct from the crazing cracks, very frequently start from some point inside the specimen and then extend rapidly radially outward.

Design Implications of Crazing

The development of crazing in stressed transparent plastics is for the most part a highly undesirable occurrence, although beneficial use is made of this phenomenon in the use of transparent brittle lacquers to predict the direction and approximate magnitude of surface stresses on machine and structural parts. In other applications, however, such as transparent enclosures on aircraft, transparent instrument panels, and as insulators in electronic apparatus, the initiation of crazing is cause for alarm either because of loss of transparency, loss of mechanical strength, or loss of dielectric properties due to moisture absorption in the crazing openings.

Since crazing once started will continue to increase without increase of load magnitude, it is well to avoid its consequences by taking every precaution to avoid its inception. As already noted, surface coatings are helpful and can be recommended. Also, working stress magnitudes should be established not merely on the basis of static ultimate strength, but on strength values at which crazing is found to occur. In applications where the plastic part may be subject to tensile stress in varying directions, full annealing of the transparent plastic sheets is highly desirable as, in this way, the material can be made more nearly isotropic. On the other hand, if the plastic part is to be used only under uniaxial tension, then higher working stresses can be obtained, without danger of crazing, by use of highly oriented material. In the oriented state all the molecular chains tend to aline in the direction of orientation, and crazing, as a result of lateral separation of adjacent chains (4), can then not occur. Crazing will, of course, occur in oriented materials and at low stress values if transverse tensile stress rather than axial tensile stress is applied. If, therefore, the intended application is such that there is a probability of lateral as well as longitudinal tensile stresses occurring, then the isotropic annealed state is preferable to the highly oriented state.

Summary and Conclusions

The effect of various factors on the inception and

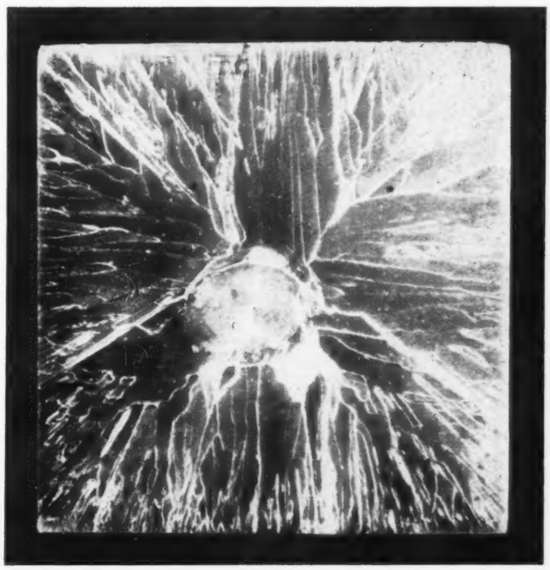

Fig. 9. Polystyrene Cross-Section Showing Both Fracture and Crazing Cracks

growth of crazing is reviewed, and some of the similarities between crazing in plastics, exposure-cracking in rubber, and stress-cracking in metals are described.

Various examples of stress crazing in transparent plastics are presented, and the stress-strain behavior is reported for crazed, non-crazed, and oriented material.

Rate of propagation of crazing has also been investigated. The test results indicate that penetration of crazing cracks in polystyrene can be represented over a limited stress range by a linear function of both time and stress magnitude. Some measures advocated for avoiding the undesirable effects of crazing include use of special coatings, annealing, and establishment of working stresses based on onset of crazing rather than on static fracture.

The authors wish to thank Prof. D. A. Kribs, of The Pennsylvania State College, for his help in making most of the crazing micrographs, and the authors also express their appreciation to the Office of Naval Research for financial support.

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Meetings and Reports

SPE Sections Meet

Two Speakers at New York

APPROXIMATELY 110 members and guests of the New York Section, Society of Plastic Engineers, attended its May 20 dinner-meeting at the Gotham Hotel, New York, N. Y. Featured speakers at the technical session were John D. Hinchen, Monsanto Chemical Co., who discussed "Quality Control in the Plastics Industry," and Robert G. Nelb, Naugatuck Chemical Division, United States Rubber Co., who spoke on "The Future of Reinforced Plastics."

Mr. Hinchen stated that the fundamental basis underlying the use of statistical methods is the principle of variation which holds that it is impossible to make two things exactly alike. Statistical quality control is designed to separate quality variations into two types: those which are normal to the operation and cannot be eliminated without basic redesign of the process, and those which are not inherent in the process and can be eliminated. After the quality limits within which production must be held have been determined, the use of statistical quality control charts permits immediate identification of any variation outside these limits. Statistics can also be applied to inspection sampling to use thorough inspection of a small number of samples to give an accurate picture of quality.

Dr. Nelb used many samples of reinforced plastic parts made with Vibrin polyester resins to illustrate his talk; he also gave a demonstration of the manufacture of glass-reinforced laminates at room temperature. The talk was devoted to a discussion of the composition and manufacture of Vibrin resins, methods of fabricating reinforced products, and the properties and applications of the finished laminates.

Table favors were distributed through the courtesy of Renwal Mfg. Co. and Naugatuck Chemical, and the meeting concluded with a drawing for door prizes contributed by Ferro Corp., Naugatuck, and Tico Plastics Corp.

Chicago SPE-SPI Meetings

The April 8 joint dinner-meeting of the Chicago Section, SPE, and Midwest Chapter, SPI, was held at the North Park Hotel, Chicago, Ill., with some 100 members and guests of the two groups attending. Speaker of the evening was Carmen R. Gianotta, M. W. Kellogg Co., who discussed "Techniques of Injection and Compression Molding of Kel-F." The talk was identical with that given by Mr. Gianotta at the SPE National Technical Conference.[1]

The two groups held their next joint dinner-meeting, May 13, at the Western Society of Engineers Bldg., Chicago. A total of 86 persons attended and heard Albert Smith, Fyffe & Clarke, speak on "Labor and Labor Relations—1953." Mr. Smith decried the continuous encroachment of labor unions on the rights of management, giving examples of contract clauses whereby unions are attempting to take over management powers or make management decisions subject to union review. Industry must resist union efforts to take over management and not depend solely on government protection, the speaker further declared.

[1] Abstracted in our Jan., 1953, issue, p. 519.

Detroit Group Meets

THE spring meeting of the Detroit Rubber & Plastics Group was held April 17 at the Detroit Leland Hotel, Detroit, Mich. The program consisted of an Oyster Bar, through the courtesy of O'Connor & Choate, Inc., followed by a dinner and meeting, at which S. L. Bass, Dow Corning Corp., spoke on "A Postwar Look at the Free Industries Countries—Western Europe and Japan." Dr. Bass gave a nontechnical talk, illustrated by many slides, on industrial conditions in Western Europe and Japan and on the progress of the rehabilitation program.

Vinyl Film Standard Approved

THE Commodity Standards Division, United States Department of Commerce, has announced that the recommended commercial standard for general-purpose vinyl film, TS-5165, which was circulated to the trade early this year, has received a satisfactory majority of signed acceptances. The recommended standard, therefore, is being issued as General Purpose Vinyl Plastic Film, Commercial Standard CS192-53, and may be considered effective for new production on or after May 22. Printed copies of the standard, when available, may be purchased from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Mimeographed copies of TS-5165 may be used until printed copies of the commercial standard are available.

Collapsible Plastic Tube

A vinyl plastic tube made of Geon resin, product of B. F. Goodrich Chemical Co., Cleveland, O., has been developed by Wallace Container Co., Los Angeles, Calif. The tube, manufactured in transparent or opaque grades in any color, is expected to find wide application in the packaging of suitable consumer items. The following advantages are claimed over conventional metal tubes: approximately one-third less weight; greater resistance to rupture from rough handling, applied pressures, and thermal expansion of the contained material; and resistance to chemical reaction with contained substances.

Cost of the vinyl tubes is said to be comparable to those made of metal, but savings are reported possible through decreased shipping charges and less breakage in handling. The unit can be filled with the regular tube-filling equipment, but heat sealing of the end requires the use of a special adapter which the manufacturer will supply.

Scientific and Technical Activities

Good Attendance at Rubber & Plastics Division, ASME, Columbus Meeting

THE meeting of the Rubber & Plastics Division of the American Society of Mechanical Engineers held, as part of the spring meeting of the parent Society, in Columbus, O., April 28 through 30, enjoyed a good attendance. The Division meeting, consisting of two half-day sessions on plastics on April 28 and one half-day session on rubber on April 29, drew between 125 and 150 persons. The rubber session had as a special feature a Symposium on Industrial Rubber Molded Products.

The first session on plastics on April 28 had as chairman, William Hedges, Columbia Coated Fabrics, Inc., and as vice chairman, Charles M. Fields, Shellmar Products Corp., Zanesville, O.

"Polytetrafluoroethylene—Its Properties and Uses," by L. W. Cornell, Minnesota Mining & Mfg. Co., St. Paul, Minn., was the first paper on the program. Mr. Cornell first explained that polytetrafluoroethylene, a comparatively new resin made by E. I. du Pont de Nemours & Co., Inc., and called "Teflon" by that company, has unique properties which enables it to do many jobs better than any other known plastic material. This plastic is serviceable between —100 and 500° F., and may be used for intermittent service up to 600° F. "Teflon" absorbs no water at all and has the interesting property of not adhering to itself or other materials.

Chemically, "Teflon" is about as inert as glass. It is attacked by molten alkali metals (sodium and potassium) and by fluorine and chlorine trifluoride, both at high temperatures and pressures. The resin, moreover, is an excellent electrical insulator for many purposes, particularly where high temperature conditions must be met.

This material is available in the form of several varieties of extruded film, cast film, molding powder, molded pieces, dispersions in water, suspensoids, etc., most of which were exhibited by Mr. Cornell.

"Unplasticized Polyvinyl Chloride—A Corrosion Resistant Structural Material," by George S. Laaff, The Bolta Co., Lawrence, Mass., was the second paper of this session. Mr. Laaff stated that the purpose of his paper was to illustrate the important position which unplasticized polyvinyl chloride occupies in today's engineering construction. The excellent chemical resistant qualities of unplasticized PVC, as well as its valuable physical properties, were pointed out. Useful information as to the testing, welding, and forming of unplasticized PVC and also various molding techniques were given along with construction and machinery details to prevent pitfalls in basic application and engineering.

Many examples of PVC pipe and rods and tubes were exhibited, and, in addition, Mr. Laaff showed slides of many industrial chemical installations in Germany where rigid PVC piping, tubing, etc., have been used in the past 15 years.

"Metal-Clad Laminates Used in Printed Circuitry," by Norman A. Skow, Synthane Corp., Oaks, Pa., was the final paper on the first plastics session program. A printed circuit is a metal reproduction of a conductor pattern which has been bonded to an insulating material, Mr. Skow explained. The simplicity and uniformity of printed circuitry offers tremendous economic advantages in the production of all types of electronic equipment. Elimination of manual wiring speeds assembly, and, because mechanical reproduction reduces the probability of error, inspection time is automatically shortened while assemblies become more uniform and reliable.

Paper or glass fiber reinforced laminates of phenolic, melamine, or silicone resins were used as the insulating material. Some of the manufacturing processes used in the production of these metal-clad laminates were mentioned.

The second session on plastics had Robert I. Leininger, Battelle Memorial Institute, Columbus, as chairman.

"Reinforced Plastics Connector Rings and Bolts for Fastening Timbers," by H. A. Perry, Jr., Naval Ordnance Laboratory, Silver Springs, Md., was the first paper of the second session. Mr. Perry described how split ring-type connectors were machined from convolute wound glass cloth, resin bound tubes and, also, how bolts, nuts, and washers were machined from panels of polyester resin-glass cloth laminate. The strength of the connections in assemblies of douglas fir timbers indicated that the reinforced plastic hardware was found to be equivalent to commercial steel hardware.

Glass fiber reinforced with melamine seemed stronger than when reinforced with polyester resins. The plastic laminates seemed equivalent in short-term tests, but no data on the effect of moisture or elevated temperature on the plastic hardware under dead load are as yet available.

"Weighed Starved Feeding for Injection Molding," by R. W. Miler, Dow Chemical Co., Midland, Mich., was the second paper of this session. A great many molders are rapidly changing over from the use of volumetric feeding units to weigh feeders because of the saving of material and the improved products obtained by the use of the latter method of feeding injection molding machines, Mr. Miler said.

The advantages of weigh feeding were given as: (1) The correct amount of material may be fed into the mold cavity. (2) Material savings are obtained. (3) More strain free parts are produced. (4) Maximum machine pressure can be utilized. (5) Lower cylinder temperatures and higher mold temperatures may be used.

Some of the disadvantages of weigh feeding were given as follows: (1) Gates must be correctly balanced; so no one part will fill before any other part does in a multiple-cavity mold. (2) Mold metals must be strong enough to withstand the maximum machine pressures transmitted to the mold. (3) The entire weighted charge must be swept from in front of the plunger at the end of each stroke. (4) The function of the ball-check nozzle is performed by the plunger.

"The Navy Looks at Structural Plastics," by W. R. Graner, Bureau of Ships, Department of the Navy, Washington, D. C., was the final paper on the plastics part of the program. The mechanical properties and characteristics of glass reinforced polyester laminates were reviewed from the standpoint of materials of construction. Structural applications in small boat hulls, shipboard piping, storage tanks, etc., now being investigated by the Navy, were described. Factors to be considered in undertaking such applications are presented for the information of the design engineer responsible for selection of materials of construction.

The third session on rubber was presided over by Stewart Brams, Dayton Chemical Products Laboratory, as chairman, with Stephen Palinchak, Battelle, as vice chairman.

"Progress in Manufacturing Methods in the Molded Rubber Products Industry," by J. H. Gerstenmaier and F. J. Fetter, Goodyear Tire & Rubber Co., St. Marys, O., was the first paper of the Symposium on Industrial Rubber Molded Products. Molded rubber and rubber and metal products are being produced in large volume at relatively low costs to close tolerances and with wide varieties of compound characteristics, it was explained by Mr. Gerstenmaier, who delivered this paper. The use of molded rubber products as functional parts in all industrial fields, plus the development of varied specialized machinery and techniques used exclusively for manufacturing molded products, has made molded rubber a separate division of the rubber industry.

Subjects discussed and illustrated were the preparation of uncured rubber, metal preparation, mold design and curing, finishing processes, and inspection and testing. It was pointed out that rubber equipment manufacturers have developed and are producing special machinery for manufacturing molded products, and the rubber manufacturers individually have developed many special process machines for all phases of preparation, curing, finishing, and inspection operations.

"Product and Mold Designing toward Lower Ultimate Cost," by J. K. Mason, Firestone Industrial Products, Noblesville, Ind., was the second paper presented at this session. It was emphasized that the engineer can make a real contribution toward more economical rubber goods mold and manufacturing costs if he will consciously make an effort to design toward the elimination of complicated and impractical features which add nothing to the intrinsic value of a part. Using specific examples of parts with which minor alterations of product design resulted in significant savings on the cost of the end-product, Mr. Mason successfully demonstrated his theory.

The paper was concluded with a questionnaire designed to assist the engineer not conversant with mechanical rubber goods manufacturing techniques and their limitations, when confronted with an order for a rubber part.

"Product Engineering," by Howard H. Armstrong, The B. F. Goodrich Co., Akron, O., was the third paper. Product engineering plays an essential role in obtaining and holding a fair share of available business for a company, Mr. Armstrong said. The product engineer's work begins with the customer's first inquiry and ends with the completion of the customer's contract, and the product engineer must be prepared to help design parts and recommend changes and materials, the speaker added.

It was pointed out that, as a rule, rubber parts are designed without any knowledge of rubber manufacturing requirements, and this practice means that blueprints must be checked carefully to find such

answers as: Can the product be made? Can it be made economically? Can the tolerances be met? Can the product be changed to produce it more economically?

The product engineer chooses the most appropriate production methods, but his responsibility does not end here. He must justify and improve the production methods. Improvements are necessary not only to improve the profit picture, but to enable the plant to be in a better position for future quotations on the same part. Mold changes, better equipment, reduction in factory operations, or in defectives are the means of making these improvements, it was said.

"Mechanical Properties of High Mooney Elastomers," by Merle J. Sanger and Paul J. Earley, General Tire & Rubber Co., Akron, was the final paper on the program. Mr. Earley pointed out that the high-quality compounds obtained from high Mooney viscosity elastomers suggest the possibility of applying this compound technique to the field of mechanical goods. The effect of higher Mooney viscosities on the mechanical properties of the compound and the effect of different types of softeners or extenders were dealt with.

A lively discussion period followed the presentation of all of these papers.

Accelerator Compounding

SPEAKER of the evening at the Philadelphia Rubber Group meeting on May 1 was B. S. Garvey, Jr., Sharples Chemicals, Inc., who discussed "Accelerator Compounding—Heat History and Compounding." Held at the Poor Richard Club, Philadelphia, Pa., the meeting included a cocktail hour and dinner and attracted an attendance of 131 members and guests.

Dr. Garvey presented evidence to support the thesis that both maximum scorch time and vulcanization time are characteristic of a compound and are dependent primarily on the accelerator, but also to some extent on the sulfur ratio, pigments, etc. The maximum scorch time may be partly or completely used up by the heat history of processing so that, for different batches, the residual scorch time is variable and depends on heat history. The vulcanization time, on the other hand, is constant and independent of the residual scorch time of a specific batch.

Since cure time is the sum of the constant vulcanization time and the variable scorch time, it also varies with the heat history of the batch, the speaker stated. This fact may explain many apparently mysterious variations in factory cures. Different accelerators vary in maximum scorch time, vulcanization time, and in the ratio of the two times. If processing heat history can be adequately controlled, it is possible to process stocks at curing temperatures or even higher.

Metal Osmometer

THE National Bureau of Standards, Washington, D. C., has announced the development of a simple, rugged device for measuring osmotic pressures of high polymer solutions. Designed by G. A. Hanks and S. G. Weissberg, of NBS, the unit consists of two nickel-plated brass cells into each of which are placed 1.2 milliliters of the polymer solution and solvent, respectively. The cells are made with a tapered hole in the top for insertion of a 0.5-millimeter capillary tube and an opening in the bottom across which is stretched a semi-permeable membrane. The capillary tubes are connected by a glass or metal bridge. The cell, membrane, and lower portion of the capillary tubes of both units are immersed into solvent or polymer solution, and osmotic pressure of the solution is determined by comparison of the levels in the capillary tubes.

Advantages claimed for this osmometer over the glass instruments are ruggedness, rapidity of assembly and cleaning, ease of operation, minimum possibility of drying the membrane, and small cell volume.

Rubber Division September Meeting in Chicago

THE third 1953 meeting of the Division of Rubber Chemistry, A. C. S., will be held in Chicago, Ill., on Wednesday, Thursday, and Friday, September 9 through 11, in conjunction with the one hundred and twenty-fourth meeting of the Society. Headquarters hotel for the Division will be the Hotel Sherman.

Since this meeting of the Division is being held with the parent Society, deadline for abstracts of papers to be presented is June 26. The Division officers realize that this date is very close to that of the Boston meeting, but when the Division meets with the Society, it must follow the rules for all Divisions.

Abstracts should be of about 200 words. They should be submitted to the secretary, C. R. Haynes, Binney & Smith Co., 41 E. 42nd St., New York 17, N. Y., in triplicate by June 26. In the letter of transmittal the following information is required: (1) the laboratory in which the work was done; (2) who will deliver the paper; (3) how much time is requested for presentation. One of the authors must be a member of the A. C. S. Three copies of the finished paper are to be delivered to the secretary at the meeting.

Herman Boxser, Western Felt Works, is the local chairman in charge of arrangements for the Chicago meeting. There will be a regular meeting of the 25-Year Club under the chairmanship of H. A. Winkelmann, Dryden Rubber Division, Sheller Mfg. Corp. Charles M. Baldwin will be in charge of the Suppliers' Cocktail Party. There will be the usual Division banquet on Thursday evening.

Chicago Group Outing

THE Chicago Rubber Group's annual summer outing will be held on Friday, July 24, at the St. Andrews Golf & Country Club, West Chicago, Ill. As in the past, the day will be devoted to golf, and the evening will feature a dinner and the awarding of prizes.

Martin Discusses Thiokols

A TOTAL of 53 members and guests of the Northern California Rubber Group attended a regular dinner-meeting on May 14 at the Elks Club, Berkeley. Speaker of the evening was S. M. Martin, Jr., Thiokol Chemical Corp., who discussed "Thiokol Synthetic Rubbers—Their Place in the Rubber Industry." Dr. Martin's talk covered the properties of the various Thiokols, the increasing industrial acceptance of these rubbers, and some of their many new applications.

In the brief business session preceding the talk, it was announced that the Group's annual summer outing will be held September 19 at the Adobe Creek Lodge, Los Altos. The drawing for door prizes contributed by the Group was won by Richard Claussen, Pioneer Rubber Mills, and Frank Groch, Pabco Products.

New High Range Strain Gage

AN ARTICLE on a new high range strain gage of very great usefulness to the rubber industry appeared in the second quarter, 1953, issue of "Testing Topics," publication of Baldwin-Lima-Hamilton Corp., Philadelphia, Pa. The authors were James A. Hurry and Richard P. Woolley, of Gates Rubber Co., who point out that the high range strain gage exhibits excellent accuracy and will probably prove useful at all frequencies and particularly in the field of rubber where large strains are encountered.

Werkenthin Guest Speaker

A TALK and film on "Shipboard Applications of Elastomer Materials," by T. A. Werkenthin, Navy Bureau of Ships, featured the spring meeting of the Connecticut Rubber Group, held May 15 in the auditorium of United Illuminating Co., New Haven, with approximately 50 members and guests attending. Mr. Werkenthin's talk was identical to that which he gave before the Chicago Rubber Group on March 27.[1]

The brief business session preceding the talk was devoted to plans for the Group's annual outing on September 12 at the Paterson Club, Fairfield.

[1] See our May, 1953, issue, p. 226.

Robson on Modern Tires

A TALK on "Tires for Modern Cars" by J. J. Robson, manager of tire engineering, Firestone Tire & Rubber Co., featured the May 20 meeting of the Washington Rubber Group. Approximately 185 members and guests attended the meeting, held in the Pepco Auditorium, following a dinner at the Touchdown Club.

Mr. Robson's talk on tire engineering discussed distortion and temperature problems at high speeds, as given in his talk at the recent Society of Automotive Engineers' meeting.[1] In addition, the speaker stated that modern, heavier cars have shown a marked shift in weight to the front end, raising problems in tire traction and cornering ability. The traction problem is being met by increased use of such devices as slots, slits, and similar gripping edges on tires. Rib stabilizers, in the form of rubber buttons in the tire shoulder groove, are being used to reduce squeal when cornering at high speeds. Mr. Robson also

(Continued on page 382)

[1] Abstracted in our April, 1953, issue, p. 81.

NEWS of the MONTH

The Rubber Study Group meeting held in Copenhagen, Denmark, the week of May 11, failed to reach agreement on the desirability or necessity of a "buffer stock" scheme, but the Group instructed its management committee to hold a special meeting in September or October of this year to take another look at the "buffer stock" proposal. The Study Group's latest estimates of new rubber production were for 1,788,000 tons of natural and 989,000 tons of synthetic rubber for a total of 2,777,000 in 1953. Consumption was estimated at 1,595,000 tons of natural and 909,000 tons of synthetic rubber for a total of 2,504,000 tons.

No action on synthetic rubber plant disposal bills had been taken by Congress by May 25, but the House Armed Services rubber subcommittee was expected to hold hearings about June 3. An interagency committee had submitted drafts to two bills to the Senate Banking & Currency Committee in early May. These bills follow the disposal procedure of the March 1 report of the Reconstruction Finance Corp. and differ only in the question of who would have final authority to approve the disposal program.

On May 8 the National Production Authority revoked Rubber Order M-2, ending 12 years of continuous government controls over the consumption of rubber.

The House of Representatives, on May 5, passed an appropriations bill denying funds for the conduct of the 1953 Census of Business, Manufactures. This action was protested by the Business Advisory Council of the Department of Commerce and The Rubber Manufacturers Association.

The rubber industry was called the "industry of eternal youth" by H. Gordon Smith, executive vice president, United States Rubber Co., in a talk before the mechanical goods division, RMA, on April 17.

P. W. Litchfield, chairman of the board, Goodyear Tire & Rubber Co., on May 11, called for full production of the government synthetic rubber plants until disposal to private industry is accomplished and the creation of a reserve stockpile of 200,000 tons of GR-S.

The RMA issued its first "Rubber Quality Bulletin" on May 6. This bulletin has as its specific objective keeping rubber consumers posted on progress of the Association's crude rubber committee activities and campaign to win universal acceptance of natural rubber quality and packing standards as defined in the official RMA Type Descriptions and Packing Specifications.

Washington Report by Arthur J. Kraft

No Agreement on "Buffer Stock" at Rubber Study Group Meeting

The International Rubber Study Group, at its meeting in Copenhagen, Denmark, the week of May 11, failed to reach agreement on the desirability or necessity of a "buffer stock" scheme, which its Working Party[1] had found a practicable method of preventing burdensome surpluses and serious shortages of rubber.

The Working Party Report, which did not pass judgment on questions of necessity or desirability, was considered by the 20 nations which sent delegations to the Study Group meeting. The Study Group, in a press communique issued May 15, announced that a "difference of opinion existed" with all major producing countries (that is, producers of natural rubber, not synthetic), and some consuming countries agreed on the "practicability" of a "buffer stock" scheme; while other countries were not convinced of the need of such a scheme, or else had not yet made up their minds.

The Study Group postponed decision on where to recommend that the Secretary General of the United Nations call an international commodity conference to develop a buffer stock organization, which would then require the assent of individual governments (the U. S. Senate in the case of the United States) before it could become operative. Instead the Study Group decided to make another try for agreement and instructed the Management Committee, on which the United States will be represented, to hold a special meeting in September or October to take a fresh look at the rubber situation, try for agreement on the major points of the "buffer stock" proposal, and determine whether agreement among member nations on the need of such a scheme "appeared possible."

The Management Committee would circulate its findings to all member governments and seek their views on whether the UN should call a commodity conference. After completing this canvass, the Management Committee was authorized to decide whether to ask the UN to call the conference, or, if not, what other action should be taken. Besides the United States, members of the Management Committee for the coming year are British Colonial and Dependent Territories, Cambodia, Canada, Ceylon, Denmark, France, Indonesia, Netherlands, and the United Kingdom. Any other member countries wishing to do so were invited to participate in the special meeting to be held on the "buffer stock" question this fall.

The Study Group also discussed a report of its Statistical Committee and came up with estimates that world production of natural rubber in 1953 would total about 1,788,000 long tons, as against a world consumption of 1,595,000 tons. It also estimated that member countries would produce about 989,000 tons of synthetic rubber and consume 909,000 tons of this total. The balance of estimated production over estimated consumption, the Group noted, will be available for absorption into governmental and commercial stocks. (While the Study Group's published figures provide no breakdown showing how much of the statistical surplus will be available for commercial stocks, it is known that the United States Government is expected to take about 50,000 tons of natural rubber this year for addition to its strategic stockpile. This 50,000 tons was bought in the past year for delivery this year, however, and will not represent new purchases.)

United States manufacturing industry representatives who attended the Copenhagen meeting issued a separate statement on May 15, setting forth their own firm conviction that the statistical edge of production over consumption should not be interpreted to mean that a burdensome surplus of natural rubber will hang over the market this year. The United States consuming industry, they said, would readily absorb all natural rubber made available to it, given even a slight decline from the prevailing market price.

The text of their statement follows:

"United States of America rubber products manufacturers believe that there can be no surplus of natural rubber during the next 12 months.

"During the 4½ months of 1953 already passed, every pound of natural rubber offered in the world markets has been sold, either for consumption or for government stockpiles.

"The current competitive situation between natural rubber and GR-S in the United States is such that there is every reason to believe that, during the next 12 months, the United States rubber-consuming industry will buy every pound of natural rubber available to them at prices competitive with GR-S.

"The recent action of the natural rubber market suggests that, at prevailing prices, an increasing preference for all grades of natural rubber is developing.

"The estimates of the Statistical Committee for 1953 show the expectation of the United States rubber-consuming industry that, through increasing use of natural rubber, the percentage usage of natural rubber in the United States during the last half of the year will be well above 40%. Even a relatively slight decline from presently prevailing prices may be expected to provide an incentive to a substantial increase in the usage of natural rubber in the United States.

"United States rubber consumers view the tonnage of natural rubber in excess of the calculated 40% usage as an opportunity for further increase in consumption, rather than as a surplus.

"If prices of natural rubber decline, rubber consumers increase the volume of their purchases for economic reasons, and normal market forces operate to set an effective floor price for natural rubber.

"In summary, we believe that normal market forces will ensure a market during the next 12 months for all of the natural rubber which will be produced and at prices which will not be substantially lower than present prices.

"We understand that natural rubber pro-

[1] See our May, 1953, issue, p. 228.

ducers have no concern regarding competition from synthetic rubber, once the plants are transferred to private ownership."

The United States delegation to the Copenhagen meeting including both delegates and governmental and industry advisers was as follows: delegate, Willis C. Armstrong, deputy director, Office of International Materials Policy, Department of State; alternate delegate, George H. Alexander, chief, Rubber, Fibers & Hides Branch, Agricultural Products Staff, Department of State; Congressional adviser, Paul Shafer, U. S. House of Representatives; government advisers, John R. Blandford, counsel of Armed Services Committee, House of Representatives; George K. Casto, chief, Rubber Division, General Services Administration; Edelen Fogarty, assistant attache, American Embassy, Copenhagen; Everett G. Holt, assistant chief, Rubber Division, NPA, Department of Commerce; Morton Yohalem, special deputy, Rubber Facilities Disposal, RFC.

Industry advisers were: John L. Collyer, president, The B. F. Goodrich Co.; Harvey S. Firestone, Jr., chairman, Firestone Tire & Rubber Co.; Frederick T. Koyle, partner, Carl M. Loeb, Rhoades & Co.; William F. O'Neil, president, General Tire & Rubber Co.; David A. Paterson, chairman, H. A. Astlett & Co.; Thomas Robins, Jr., president, Hewitt-Robins, Inc.; George M. Tisdale, vice president, U. S. Rubber; Gilbert K. Trimble, executive vice president, Midwest Rubber Reclaiming Co.; A. L. Viles, president, RMA; Robert S. Wilson, vice president, Goodyear; R. D. Young, president, Rubber Trade Association of New York, Inc.

The above-mentioned Study Group estimated world production and consumption of natural and synthetic rubbers according to country or location follow:

ESTIMATED NATURAL RUBBER PRODUCTION IN 1953

(In 1,000 Long Tons)

Malaya	590
Indonesia	740
Ceylon	96
Viet-Nam & Cambodia	69
Thailand	100
British Borneo	50
Burma	10
Liberia	37
British Africa	20
Belgian Africa	20
French Africa	3
Other countries	53
TOTAL	1,788

ESTIMATED SYNTHETIC RUBBER PRODUCTION IN 1953

(In 1,000 Long Tons)

United States of America	*905
Canada	*79
Germany	5
TOTAL	989

*Including the oil content of oil-extended GR-S.

ESTIMATED NATURAL AND SYNTHETIC RUBBER CONSUMPTION IN 1953

(In 1,000 Long Tons)

	Natural	Synthetic*	Total
U. S. A.	575	†824	1,399
United Kingdom	201	5½	206½
Belgium	15	2	17
Denmark	5	‡	5
France	110	12	122
West Germany	97½	11	108½
Italy	40	8	48
Netherlands	15	½	15½
Australia	30	‡	30
Canada	35	37	72
Japan	66	1	67
Other countries	405	8	413
TOTAL	1,594½	909	2,503½

*Excluding Russian produced synthetic rubber.
†Including the oil content of oil-extended types.
‡A small amount of synthetic rubber is expected to be used.

The Study Group's statistical estimates, according to observers here, are somewhat higher than anticipated in the case of Indonesian production and United States use.

The Study Group, in its official communique, also reported the following:

"The Group, as at a previous meeting, examined various aspects relating to the expansion of world consumption of rubber. The Group considered that the use of rubber in roads was one of the most important potential outlets for rubber, but that its full development was a matter for further intensive study and promotional effort. The Group also agreed that recent developments in the adoption of latex foam for upholstery and its firm establishment in popularity encouraged the view that this was probably the most immediate new avenue for the consumption of large quantities of rubber, but that the selling price of liquid latex was an important competitive factor.

"The Group again examined a number of problems relating to the packing, shipping and marketing of natural rubber and in particular problems relating to type samples were again discussed. The Group noted that this meeting of the Packing and Marketing Committee had produced a greater degree of agreement on rubber type samples than had been reached between representatives of terminal and primary rubber markets on previous occasions. The Group welcomed the joint proposal of the Rubber Manufacturers Association and the Rubber Trade Association of New York that a meeting should be held between consumers, producers, packers and shippers in order to discuss packing specifications and other matters of mutual interest.

"The Group also reviewed the development in the supply of Technically Classified Natural Rubber and noted that some 25,000 tons had been provided in 1952. Current problems associated with this development were examined.

"The technical and practical problems associated with the assessing of dirt content were also examined and the work being done in this connection commended."

The Study Group accepted the invitation of the Ceylon Government to hold its next annual meeting in Ceylon, at a date to be decided later. It may be of interest to note that on the eve of the Copenhagen meeting, a press dispatch from Ceylon appeared in the British press declaring that Ceylon had decided not to support the "buffer stock" proposal because it foresaw no burdensome surplus for Ceylonese rubber. The dispatch noted that Ceylon felt its recent five-year purchase agreement with Communist China, under which China agreed to buy 50,000 tons annually of Ceylon's rubber, removed any threat of an unmarketable surplus for Ceylon's output. If the press dispatch is accurate, it would appear that next year's host country is not regarded by the Study Group as one of the world's major natural rubber producers, even though it ranks third in total rubber output. In its communique, the Study Group said that "all main producing countries" considered measures "necessary and practicable" to prevent a burdensome surplus. It would appear that Ceylon was not included in the term "all main producing countries." Indonesia, it is well known, is the most powerful proponent of the "buffer stock" scheme; while opinion among Malayan producer interests was reportedly divided, with the major estates against a "buffer stock" plan, and smallholder interests for it.

Synthetic Plant Disposal Bills Being Drafted

As this is written [May 21], Congress had not yet got around to scheduling action on disposal of the synthetic rubber facilities to private industry. Several bills were in the works, however, and the two Congressional committees directly involved had indicated they would hold public hearings the first week in June.

Paul W. Shafer (Rep., Mich.), chairman of the House Armed Services rubber subcommittee, announced in Copenhagen, where he attended the International Rubber Study Group meeting as adviser to the United States delegation, that he would introduce disposal legislation on his return to Washington. He was due back on May 26. His subcommittee, which earlier had hoped to open several days of final hearings on disposal in late May, was reported ready to open hearings about June 3.

Meanwhile an interagency committee, made up of rubber experts from various administrative agencies, had prepared a draft bill and submitted it to the Senate Banking & Currency Committee early in May. The draft was under study by committee staff members and was expected to receive personal consideration of Committee Chairman Homer Capehart, of Indiana, and Committee Member John W. Bricker (Rep., Ohio), as the basis for a disposal bill to be introduced by them prior to committee hearings on disposal.

The administration draft follows in detail the disposal procedure set forth in the March 1 report of the Reconstruction Finance Corp. to Congress and the White House,[2] which spells out disposal procedures and conditions in some detail. Actually, two drafts were submitted by the interagency group to the Banking committee. They were identical in all respects save one: the question of who would have final authority to approve the disposal program worked out by RFC and industry.

In its March 1 report RFC had recommended that once negotiations are completed, the disposal program, which would contain a complete list of sale contracts, be submitted to the Congress. The sale contracts would take effect if neither chamber of Congress, within 30 days, voted by resolution to disapprove them. This provision was incorporated in one of the two drafts submitted to the Banking committee.

The second draft would leave final approval up to the President. Just why this procedure was suggested has not been clarified, at this writing. As far as it could be ascertained, several members of the interagency drafting group felt that the RFC proposal might isolate the administration from final responsibility for whatever disposal program is developed. They had in mind the possibility that negotiations might not prove so fruitful as might be hoped. Should they result in contracts for only a relatively few plants, for instance, the President might feel impelled to regard the disposal effort as a failure and might so wish to advise Congress.

Under the proposal originated by RFC, there would be no opportunity for the President to go on record formally with a recommendation that Congress regard the disposal program as inadequate for the national security, and perhaps authorize a fresh approach, or pass legislation confirming. Should the disposal negotiations appear disappointing, the RFC recommendation would result in a similar report—but it would lack the force of a Presidential policy recommendation on how Congress should handle the future of the synthetic rubber industry. Also, there is the

[2] See our Apr., 1953, issue, p. 82.

possibility that RFC might feel differently than other government agencies about the results of its negotiations. RFC might like them; while others might not. By cutting the President out of the picture, Congress would have to decide on the basis of an RFC report and recommendation, without having the advice of other interested agencies—such as the Justice Department's anti-trust division, to name one. Since all agencies interested in the outcome of disposal negotiations are subservient to the White House, the President would be in a logical position to serve as arbiter.

There appears to be no compelling reason why the final disposal procedure could not incorporate both methods, with RFC reporting the results of its negotiations to the President, and the President transmitting these with whatever recommendations he may wish to make to the Congress. The contracts could then take effect within the 30-day period, unless Congress disapproved. Perhaps such a procedure was intended, but the intent of the interagency committee was not quite clear to the Banking committee. It seems more than likely that Senators Capehart and Bricker will ascertain the intent of the administration on what method of final approval it wants adopted before they introduce a disposal bill.

Synthetic Production and Consumption

The Office of Synthetic Rubber, RFC, has announced that it sold 63,083 long tons of GR-S and a whopping 8,503 tons of butyl rubber in April, and scheduled May production of 68,800 of GR-S and 6,400 tons of butyl. The May production figure should exceed sales for the month by a comfortable margin, permitting RFC to restore GR-S inventories, which were depleted as consumption exceeded production each month since last October. April production, at 63,221 tons, barely edged past that month's sales figure, marking the first month this development occurred for some time.

RFC expects to boost its current hand-to-mouth inventory GR-S to about 35,000 tons by the end of this fiscal year, June 30, 1953. The latest available figure is for March 31, when government stocks totaled 25,567 tons, actually 1,800 tons less than on February 28. Industry stocks of GR-S, including those in transit from RFC warehouses to consumer plants, gained during March, reaching 58,545 tons at the month's end, up about 4,500 tons from the February 28 figure.

RFC, which has been selling small quantities of alcohol butadiene to commercial users, knocked down its selling price from 32¢ to 22¢ a pound last month. RFC is making butadiene available to commercial users because an insufficient supply is available from private production, and RFC is in a position to spare some of its butadiene output to other users. The price reduction was made possible by the acquisition of lower-cost alcohol supplies under contracts signed within the past few months with private alcohol suppliers. The 22¢ price for alcohol butadiene is very close to production cost, RFC officials confirmed, which supports the belief that current costs of producing GR-S from alcohol butadiene are not far from the current 23¢ a pound selling price for GR-S.

Here are the detailed figures on RFC's synthetic rubber sales in April and the production scheduled for May:

April sales—total GR-S (including oil extenders, but not carbon black), 63,083 long tons; LTP, 39,034 tons; black masterbatch, 9,625 tons (gross weight including black); oil masterbatch, 12,288 tons (gross weight); oil-black masterbatch, 1,849 tons (gross weight); GR-S latex, 4,255 tons; butyl, 8,503 tons.

May production—total GR-S, 68,800; LTP, 44,100 tons; black masterbatch, 6,100 tons; oil masterbatch, 14,600 tons; oil-black masterbatch, 1,800 tons; GR-S latex, 4,650 tons; butyl, 6,400 tons.

CALENDAR

June 15-19.	**Exposition of Basic Materials for Industry. Grand Central Palace, New York, N. Y.**
June 16.	**Buffalo Rubber Group. Summer Outing. The Transit Valley Country Club.**
June 19.	**Boston Rubber Group. Summer Outing.**
	Akron Rubber Group. Summer Outing. Firestone Country Club.
June 29-July 3.	**American Society for Testing Materials. Annual Meeting. Chalfonte-Haddon Hall Hotel, Atlantic City, N. J.**
July 24.	**Chicago Rubber Group, Summer Outing. St. Andrews Golf & Country Club, West Chicago, Ill.**
Aug. 4.	**New York Rubber Group. Golf Tournament. Baltusrol Golf Club, Springfield, N. J.**
Aug. 21.	**Philadelphia Rubber Group. Annual Outing. Cedarbrook Country Club, Philadelphia, Pa.**
Sept. 9-11.	**Division of Rubber Chemistry, A. C. S. Sherman Hotel, Chicago, Ill.**
Sept. 12.	**Connecticut Rubber Group. Annual Outing. Paterson Club, Fairfield, Conn.**
Sept. 17.	**Southern Ohio Rubber Group. Engineers' Club, Dayton, O.**
Sept. 19.	**Northern California Rubber Group. Summer Picnic. Adobe Creek Lodge, Los Altos, Calif.**
Oct. 6.	**Buffalo Rubber Group. Hotel Westbrook, Buffalo, N. Y.**
	The Los Angeles Rubber Group, Inc. Hotel Statler, Los Angeles, Calif.
Oct. 8.	**Northern California Rubber Group.**
Oct. 14.	**Newark Section, SPE. Military Park Hotel, Newark, N. J.**
Oct. 21.	**Washington Rubber Group. Washington, D. C.**
	New York Section, SPE. Hotel Gotham, New York, N. Y.
Oct. 27.	**Association of Consulting Chemists & Chemical Engineers, Inc. Twenty-Fifth Anniversary and Annual Meeting. Hotel Belmont Plaza, New York, N. Y.**

NPA Controls End Completely

On May 8, NPA brought to an end 12 years of continuous government controls over the consumption of rubber, by revoking NPA Order M-2. Since it was an announcement so long awaited by the rubber industry, the text is quoted, as follows:

"NPA Order M-2 (18 F.R. 1724) is hereby revoked. This revocation does not relieve any person of any obligation or liability incurred under NPA Order M-2 as originally issued or as amended from time to time, nor deprive any person of any rights received or accrued under said order prior to the effective date of this revocation. This revocation is effective May 8, 1953."—By order of George W. Auxier, Executive Secretary, National Production Authority.

The revocation removed the last of the restrictions on the use of natural rubber, that of pale crepe rubber in pneumatic tires. It also removed the requirement for marking butyl tubes, which had been instituted to permit the sorting of scrap tubes when being reworked in the process of making reclaimed rubber. NPA recommended that this practice be continued by tube manufacturers on a voluntary basis. The filing of reports previously required by M-2 is still required, under provisions of the Rubber Act of 1948, as amended.

In revoking M-2, NPA said that military stockpile requirements for pale crepe can be met without restraints on civilian use. Consumption of pale crepe in white sidewall tires has been reduced considerably, NPA noted, by technological changes, and even if manufacturers resume using pale crepe in whitewalls, not more than 5,000 tons a year would be required.

"This amount," NPA stated, "would not create a shortage, nor would it offer a threat to the stockpile."

Consumption controls were first imposed in June, 1941, when the government embarked on a worldwide preclusive buying program to build up United States stocks of natural rubber and keep them out of enemy hands. Controls, in one form or another, were continued under the old R-1 Order and then under M-2 until May 8.

"Census of Manufactures" To Be Abandoned?

In voting the appropriations bill covering operations of the Department of Commerce (HR-4974) on May 5, the House of Representatives sustained the action of its Appropriations Committee in denying funds requested to conduct the 1953 Censuses of Business, Manufactures, Transportation and Mineral Industries.

American business interests, speaking through the Business Advisory Council of the Department of Commerce, protested strongly against this "economy" move in Congress. On May 6, RMA, in a bulletin to rubber manufacturers, suggested that companies which have found the census a "useful tool of business planning" wire Senators and Representatives urging the funds be restored by the Senate Appropriations Committee. The RMA bulletin pointed out that the Census of Manufactures was first conducted in 1810. Preliminary work on the 1953 Census of Manufactures is already well along with funds voted the Bureau of Census by the 82nd Congress. To assure that the 1953 Census would develop information of greatest possible usefulness to rubber manufacturers, the RMA last summer surveyed a large and representative number of member companies to develop information that would be helpful to the Bureau in designing its questionnaire.

The Advisory Council resolution, passed May 9 at its meeting in Hot Springs, Va., urged Commerce Secretary Sinclair Weeks "to take all steps possible to persuade the Congress to restore the funds." Mr. Weeks transmitted a copy of the resolution to Senator Styles Bridges, chairman of the Senate Appropriations Committee, on May 12, the day after the committee met to consider the House action.

According to unconfirmed report, there will be no effort made to restore the appropriation at this time. It was understood, however, that a "gentleman's agree-

ment" has or will be reached, under which Mr. Weeks would return to the House and Senate appropriations committees later for a supplementary appropriation, which would include funds for the business censuses. Under this reported agreement both committees would accede to this request, and the necessary funds would be made available, although a little late. Work on the censuses, already in its preliminary stage, could continue without interruption, although perhaps at a slower pace than anticipated. Expenses would be made up in a deficiency appropriation, rather than assured in advance.

The Business Advisory Council resolution pointed out further that: (1) the regular gathering of statistical material by the Bureau of Census provides businessmen with information to make vital day-to-day decisions in the operation of their business; (2) current and timely statistical material is essential to maintain economic stability and to attain the national objective of ever-expanding economy; (3) the justification for the elimination of Census funds was that it represented a deferment in spending $21 million, based on the original budget for fiscal 1954 submitted by President Truman, while, in fact, the revised budget for the Bureau of Census called for $11.5 million for fiscal 1954 for four censuses; (4) the estimated cost of $11.5 million represents a real saving over comparable censuses taken in earlier years; (5) the law under whose authority these censuses are taken specifies that they be taken every five years, so that if they are not taken as of this year, there is great danger that no censuses may be taken until 1958; and (6) a ten-year statistical gap would work extreme hardships on businesses which rely on Census material for efficient operation.

ODM May Become Permanent

The Administration's Reorganization Plan No. 3, which would establish the Office of Defense Mobilization as a permanent mobilization planning agency and give it jurisdiction over defense stockpiling of strategic materials, seems slated to take effect without opposition on June 12.

The plan was transmitted to Congress by President Eisenhower on April 2. Under the terms of the Reorganization Act, it would take effect automatically if either house of Congress failed to disapprove the plan within 60 days. Allowing for a 10-day Easter recess, this puts the automatic effective date at June 12, barring unforeseen opposition.

As proposed by the President, the new permanent civilian mobilization agency will have two main functions: planning the nation's defense needs on the industrial and civilian front, both for the short and long range; and maintaining a nucleus organization equipped to administer direct economic controls, including the few remaining on the books and the many more which would be resorted to in event of grave national emergency.

ODM, as reconstituted by Reorganization Plan No. 3, will absorb the economic planning functions of the National Security Resources Board and the stockpiling functions of the Defense Department's Munitions Board. It was to the latter transfer of authority that some opposition might have been expected, but which, to date, has not materialized. Several years ago the House Armed Services Committee successfully opposed transferring stockpile administration from the Defense Department to a civilian agency, with Rep. Carl Durham (Dem., N. Car.), author of the Stockpiling Act, leading the opposition to the proposed transfer.

The military felt that military men could better resist the frequent pressures from commercial interests to accommodate stockpiling operations to market considerations. It has little faith in the ability or desire of civilian administrators, particularly if they were drawn from the ranks of business, to stand fast against such pressures. Possibly after the past two years of experience with civilian agencies taking a hand in determining the pace of stockpile operations, the military may not have as strong fears, in this connection.

Under the new ODM set-up, the Munitions Board will retain some influence on stockpiling decisions, since it will be represented on the Interagency Materials Committee which will cut up the materials pie to serve both military and civilian requirements. The final decisions, however, will rest with the Office of Defense Mobilization —a civilian agency.

The logic of putting under one roof the power to decide how limited supplies of materials will be used in a partial mobilization economy is readily apparent from past experience. The success of the program, however, will rest on the ability of that central authority to evaluate and appreciate the proper role of the various parties involved, and deal equitably in ruling upon their often conflicting demands on the materials supply.

It will be recalled that with the outbreak of the Korean War, the Munitions Board embarked on its tremendously accelerated rubber stockpiling program, draining off huge tonnages of natural rubber from a limited supply. Rubber consumers protested that the stockpile demands were excessive and would result in shortages of essential civilian rubber goods. The civilian agency to which they protested—the National Production Authority—appreciated the problem, but informed the consumers that it was powerless to intervene effectively to curb the stockpile program. NPA could do no more than accept the Munitions Board's demands and, through restrictions on civilian consumption, made certain these demands were met. It took some months and a hard-fought battle before an "umpire" was brought in to rationalize the conflicting claims on rubber supply. An interagency committee, headed by Defense Production Administrator Manly Fleischmann, was established to weigh the conflicting demands and make recommendations. The umpire, in cases of unreconciled disputes, was exercising the authority of the President, under a carte-blanche from Defense Mobilizer Wilson.

The best features of the above plan have been incorporated in Reorganization Plan No. 3, which sets up a permanent government agency, whose responsibilities and actions possibly will transcend those of any other government agency in their direct impact on manufacturing industries for some time to come.

Other National News

"The Industry of Eternal Youth"

H. Gordon Smith, executive vice president, U. S. Rubber, in a talk before the Heavy Mechanical Goods Division, RMA, in White Sulfur Springs, W. Va., on April 17, pointed out that the rubber industry was an important exception to the general rule that a growth industry was a young industry that had not reached the size of long-established industries. The rubber industry, he said, was an old industry that was still growing.

The automobile and chemistry are the two main factors which have shaped the rapid growth of the rubber industry in the past and which will continue to make it grow like a youthful industry in the future. The use of automobiles is still increasing and at a rate even faster than the growth of the population in this country. Greater expansion for the tire business is expected from trucks and buses, where the number of buses used in inter-city travel has more than doubled in the last 10 years. In the modern car, tires account for less than half the total rubber used, and then there is the continued rapid growth of the use of the airplane which cannot function without rubber parts. In other types of transportation, rubber and fabric conveyor belts are increasing greatly in use, and now we are opening the door to the use of conveyor belting to haul passengers and freight.

Each year rubber becomes more and more a chemical industry in many aspects —in its raw materials, in its production techniques, and in its end-uses, it was said.

These raw materials fall in three main classes, synthetic rubber, plastics, and synthetic textiles. The rubber industry's experience in developing and producing synthetic rubber has led it into the field of plastics, and as the rubber companies expand into the production and use of plastics, they take on new business in fields where growth is doubling every five years or less, Smith added.

The rubber industry will continue to use plastics wherever they give the best performance and will use rubber wherever it continues to be superior.

"We will use whatever material will do the job, because we are not just in the rubber business. We are in the business of serving customers, and customers usually get what they want and are willing to pay for," the speaker continued.

Concurrently with the rubber industry's growth in plastics, the use of synthetic textiles has been expanding, and synthetic tire cords have about replaced cotton.

In 1953 the rubber industry expects its sales to reach 5.6 billion to set a new record, and defense business will use only 7.5% of the total rubber consumed. Civilian tire demand should exceed 93 million units, an increase of 13% over 1952 figures, and increases in the sale of foam rubber mattresses and cushioning, footwear, chemicals, and plastics are expected.

Looking beyond 1953, the industry is expected to continue its past dynamic growth, matching or exceeding the average for all industry. The past rate of increase in the consumption of rubber, projected over the next eight years, gives a 1960 consumption figure of 1.6 million tons, or about 21 pounds per person, an increase of 17% over the present figure.

The rubber industry is vital, Smith added. It is versatile—it makes 30,000 different products, serving people in transportation, recreation, clothing, industry, housing, and the preservation of good health. As people continue to live better, they will continue to use more and more rubber. The rubber industry has never stopped growing and never will, the speaker concluded.

Litchfield Asks for Peak Synthetic Production

P. W. Litchfield, Goodyear chairman, on May 11 called for a program to prevent any interruption of synthetic rubber production during the approaching transfer of synthetic rubber plants from government to private ownership, in another of his "Notes on America's Rubber Industry—The Synthetic Industry from Infant to Indispensable Giant in 10 Brief Years."

Emphasizing that the war-born synthetic rubber industry is vitally essential to America's security and progress, Litchfield said the following steps are necessary to protect the nation's interests:

(1) That full production schedules be maintained between now and the time the synthetic plants are finally and officially transferred to private ownership and operation.

(2) That we begin now to create a reserve stockpile of at least 200,000 tons of synthetic rubber, building from excesses beyond current needs.

The first step is essential, he said, to provide enough synthetic rubber for our needs and to keep the price of natural rubber within reasonable bounds.

The stockpile is needed for security reasons, accentuated by the possibility of interruption of production levels during the change of ownership, possibly as long as two years.

While the current situation is "comfortable," with supplies of natural and synthetic in balance with demand, and at reasonable prices, we must not be lulled into a sense of false security, Litchfield warned, citing the Communist aggression in Indo-China, which threatens the security of the rubber growing areas of southeastern Asia, the approaching disposition of government-owned synthetic plants to private corporations, and the steadily increasing demands for rubber. He pointed out that by 1960 these total needs will exceed present total capacities, natural and synthetic combined, by 25%.

Litchfield could see little hope for a significant increase in the output of natural rubber in the foreseeable future and added that the difference between the total need of rubber and the available supply of natural rubber is, of course, made up by the output of the synthetic rubber industry, which is mostly centralized in this country.

RMA Rubber Quality Bulletin

Under the date of May 6, RMA issued its first "Rubber Quality Bulletin," which has the specific objective of keeping rubber consumers posted on progress of the Association's crude rubber committee activities and campaign to win universal acceptance of natural rubber quality and packing standards, as defined in the office RMA Type Descriptions and Packing Specifications.

This first bulletin covers major developments in these fields since December, 1952, when the RMA quality seminars were concluded.

It was reported that the Rubber Trade Association of New York had announced the formation of an RTA crude rubber committee headed by Joseph Louis, of Littlejohn & Co., Inc. The RTA committee is made up of five dealer representatives and five representatives of shippers agents.

The matter of an international conference on rubber quality and packing[3] was also reported, and some mention of the recent meeting of the Rubber Study Group[4] in Copenhagen was made. W. J. Sears, vice president of the RMA and chairman of its crude rubber committee, will discuss mutual problems with representatives of French, German, and British rubber manufacturing associations at Paris, Frankfurt, and London, before and after the Copenhagen meeting, to determine how widely RMA standards are accepted in the overseas manufacturing industries.

Considerable improvement in the overall quality of natural rubber imports is reflected in a current analysis of rubber that came into the United States in 1952. The current report is based on consolidated figures of General Services Administration as exclusive importer during the first half of 1952 and private imports during the last half based on reports of members of the RMA and the RTA of New York.

In contrast to 1951[5], the new analysis shows that off-grade imports dropped from 41.6 to 34.6%, and that 3.6% was below the grade contracted for. The analysis of second-half imports under private purchase showed an even better picture, with 28% of the imports off grade, and only 2.9% as much as one or more grades below contract grade.

Improvements, however, were limited principally to Ribbed Smoked Sheets, Thin and Thick Pale Crepes, and, to a slight extent, Estate Thick and Estate Thin Brown Crepes. There was no improvement in Thin Brown Crepes or Thick Blanket Crepes (Ambers). For all other types and grades, at least 75% of the imports conformed to RMA standards, indicating the ability of the natural rubber industry in general to pack and ship in conformity to those standards, it was said.

A regular and cooperative exchange of information between the RMA Crude Rubber Committee and the Malayan Rubber Export Registration Board has developed since January 1 when the new Rubber Shipping and Packing Control Ordinance was made effective in Singapore and the Federated Malayan States.

The Board has made available to the RMA Committee and United States consumers a complete list of several hundred shippers and packers registered under the ordinance and has advised that it had issued, as of February 26, 1953, a total of 1,039 registration certificates.

Under the new export regulation, bales must carry: (1) the packer's certificate registration number, house symbol, or mark; (2) the grade of rubber contained in the bale or package; (3) the shipper's certificate registration number and house symbol or mark; and (4) in the case of rubber shipped for sale on sample the mark U. E. R. (Unspecified Estate Rubber).

At the ninth meeting of the International Rubber Study Group in Ottawa, Canada, the United States delegation agreed to consider proposals to establish two new types below RMA #3 Amber and below the RMA #4 Amber. In January, 1953, the joint RMA-RTA Type Sample Committee examined samples of Singapore Type "C" and "D" Blanket Crepes submitted by the Singapore Chamber of Commerce Rubber Association and, on the average found the Type C sample to be approximately ⅜ of a grade lower than the RMA #3 Thick Blanket Crepe. The Type D sample was found to be equal to all practical purposes to the RMA #4 Thick Blanket Crepe.

The SCCRA was advised of these findings on February 11, 1953, and was informed that the RMA would amend its Type Descriptions to recognize Singapore Type C Blanket Crepe, although the Type C would not be given an RMA classification, because of the degree of overlapping between that type and the RMA #3 Blanket Crepe.

Agreement to make recognition of the Type C effective was made conditional on advice from the Far East that the change would meet the point raised by producer representatives at Ottawa. It has since been learned that the Singapore samples have not been approved or accepted by other organizations in Malaya or by interested parties in Indonesia.

From the foregoing, the RMA said, it seems apparent that the organizations in producer nations did not consult among themselves to arrive at mutually satisfactory quality standards for Thin Browns and Blanket Crepes.

The joint RMA-RTA Type Sample Committee was then instructed to investigate the quality of incoming shipments of these two types from all sources. During the period from March 9 to April 20, 1953, the Type Sample Committee arranged for the selection of many representative samples of #2, #3, and #4 Thin Brown and #3 and #4 Blanket Crepe from current arrivals of rubber produced in British Malaya, Indonesia, and Siam. The samples of current arrivals were carefully compared with the current RMA type samples for these five grades, and the Type Sample Committee unanimously concluded that these samples from current arrivals were generally equivalent to RMA standards; therefore there was no necessity for revising the present RMA type samples for these grades.

This investigation definitely proved that the remilled grades produced in Indonesia are of consistently higher quality than the same grades produced in other areas. The quality received from the latter areas has declined steadily since the RMA type samples on these grades were established in 1950; while the quality of rubber from Indonesia has improved during the same period.

Substantial production increases in Technically Classified Rubber reflect the growing interest in this-type rubber. Output rose from 8,853 long tons in 1951 to more than 22,000 tons in 1952. These figures do not include Indonesian production, which was not begun until September, 1952.

The RMA announced that the 96-foot panel display used in connection with the Crude Rubber Quality Seminars and the complete set of official RMA Type Sample Books used in that program have been turned over to the University of Southern California for use as a permanent display in connection with the newly established rubber technology courses in the University's School of Engineering.

The RMA Crude Rubber Committee has directed the editing and publication of all documents presented during the quality seminars, including questions and answers developed, and distribution is planned to rubber manufacturers, schools, colleges and universities, and public libraries.

In addition, the Committee, with a view to reporting on the progress of the quality campaign, has established a speakers'

[3] India Rubber World, May, 1953, p. 230.
[4] *Ibid.*, p. 228.
[5] *Ibid.*, Nov., 1952, p. 229.

bureau service. Local rubber groups and other organizations throughout the country interested in scheduling such speakers during their 1953-54 programs, beginning next autumn, are invited to contact the committee through Charles C. Miller, secretary, RMA, 1832 M St., N. W., Washington 6, D. C.

Sales and Inventory Figures

The Office of Business Economics, United States Department of Commerce, in its "Industry Survey" publication for April-May, 1953, has provided some additional figures for rubber goods manufacturers' sales and inventory figures for 1952 that permit a tabulation for the entire 12 months of that year. Similar information for the first two months of 1953 is also provided, which confirms the increased volume of business reported for the beginning of the current year.

VALUE OF RUBBER GOODS MANUFACTURERS' SALES

(Adjusted for Seasonal Variations; Millions of Dollars)

1952												1953	
Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.
468	442	406	437	424	430	408	408	482	464	438	438	507	499

BOOK VALUE OF MANUFACTURERS' INVENTORIES

(Seasonally Adjusted; Millions of Dollars)

1952												1953	
Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.
840	848	865	877	878	864	884	884	877	874	879	936	915	887

Unfortunately, sales and inventory figures for March, 1953, the latest record month for rubber consumption, are not available at this time. The above manufacturers' sales figures for 1952 total $5.245 billion. Similar figures for 1951 were $5.264 billion; for 1950, $4.32 billion; for 1949, $3.05 billion; and for 1948, $3.35 billion.

Expands in Chemicals

The Goodyear Tire & Rubber Co., Akron, O., plans to invest approximately $5,500,000 in expansions of its chemical plants in Niagara Falls, N. Y., and in Akron.

A new plant, consisting of four factory units and additional equipment, will be built at Niagara Falls at a cost of approximately $4,000,000 for the production of rubber compounding accelerators and antioxidants and of vinyl plastic resins. The Akron expansion will comprise an addition to the Chemigum plant for the increased production of Pliolite S-5, paint latex, and Chemigum rubbers.

Goodyear Employment High

Goodyear last month announced that it is currently employing more than 100,000 persons in its worldwide organization. This figure represents a new peacetime high for the company, which began operations in 1898 with only 13 persons.

It was also announced that sales, tire production, and rubber consumption tonnage for the first quarter of this year were at all-time peaks.

Names Special Representatives

Goodyear's chemical division has appointed William E. Kelly and John D. Hunter special representatives.

Kelly, who has had extensive experience in chemicals in the rubber, adhesive, and textile fields, will handle Chemigum rubbers and latices and Pliolite reinforcing resins to increase service in the New York area.

Hunter, who will specialize in Pliolite resins and latices for the paint industry in the chemical division's Midwest district, has a long background in research and development work on coatings and impregnants. His headquarters are in Chicago.

Porolated Vinyl Film

A vinyl plastic film which is claimed to be rainproof and at the same time to permit a high rate of air transmission has been developed by Goodyear. Approximately 700% greater moisture-vapor transmission is reported for the Porolated Vinylfilm, as compared to regular vinyl film. Rainwear, infants' wear, etc., seem probable applications for the material, which is processed continuously and can be fabricated and bonded on standard equipment.

Flooring and Cushioning in Trains

Rubber flooring and Airfoam cushioning, products of the Goodyear Company, are being used in four new streamline railway trains recently placed in operation by the Chicago, Burlington & Quincy Lines. The cars, which were built by Budd Co., employ the rubber tile to absorb shock, deaden sound, and resist abrasion, and the Airfoam cushion to provide comfortable seats for passengers.

Desert Tones for Rubber Flooring

The Goodyear flooring division has announced a new style of rubber flooring called Desert Tones. The style group is composed of five new shades, based on natural desert colors, and they were created exclusively for Goodyear by Raymond Loewy Associates. The flooring is available in both tile and roll goods in three gages of $\frac{3}{32}$-, $\frac{1}{8}$-, and $\frac{3}{16}$-inch.

Passenger Conveyor System

A 15-foot working model of the design for a passenger conveyor system to operate between Grand Central Terminal and Times Square in New York, N. Y., was exhibited recently to New York city and state officials, businessmen, and transportation experts. The scale model demonstrated the operation of the system proposed by Goodyear and Stephens-Adamson Mfg. Co. to carry a maximum of 32,000 passengers per hour over a distance of approximately $\frac{2}{3}$ mile.

Passengers step on to loading platforms moving at the rate of $1\frac{1}{2}$ miles per hour and then into cars traveling at this same rate. The cars are uniformly accelerated by means of pneumatic-tired rollers to 15 miles per hour, at which time they leave the rollers and ride on a constant-speed conveyor belt. Deceleration and unloading occur in similar fashion, and the empty cars continue around a pivot for the return trip on the continuously moving system.

Installation costs of the conveyor system within the tunnels which now contain the conventional subway cars and equipment are estimated at 60% of the cost for modernizing existing facilities, and operation and maintenance costs are estimated at 40% of present expenditures. The additional capacity (approximately 39%) is another advantage claimed for the system. It is reported that other cities are interested in possible modifications of this conveyor system to suit their respective transportation problems.

Expanding Research Department

Three key appointments were announced May 7 by James N. Mason, director of the recently expanded research and development department of Boston Woven Hose & Rubber Co., Cambridge, Mass. Donald Johnston becomes manager of hose development; Edward E. Stritter takes over as plastics development manager; while William E. Wells heads the belt development division.

BWH is extending its research and development center's facilities specifically to devise new, better, lower priced products, to improve, if possible, existing processes and machines, or to pioneer entirely new ones. This company area is expected to perform vital services for both the manufacturer of mechanical rubber goods and plastics and its customers.

Mr. Johnston started in the company's inspection department more than 17 years ago. He was, more recently, plant superintendent and superintendent of process engineering.

Mr. Stritter has also been with the company 17 years, the last four as assistant technical superintendent.

Although William E. Wells has been with BWH just over four years, concentrating on V-belts and short flat transmission belts, he boasts nearly a quarter-century's experience in the rubber industry as a product engineer.

More Bull-Dog Tubing

The company has announced two additions to its Bull Dog all-rubber boxed tubing, a $\frac{5}{16}$-inch and a $\frac{3}{8}$-inch inside diameter material, both of $\frac{1}{16}$-inch wall thickness. These additions are expected to provide a wider range of sizes better to service customers' requirements.

Rayon Conveyor Belts for Mines

A transverse sample section of a newly developed rayon conveyor belt was displayed at the National Coal Show in Cleveland, O., by Boston Woven Hose. The rubber and rayon carcass belt, still undergoing field testing, is not yet in production by the company. Advantages claimed for the new product include: light weight; no overcured sections; low stretch; long flex life; and a high ability to withstand mildew.

Charles S. Mohaupt has been named acting technical superintendent of the aeronautical manufacturing division of The B. F. Goodrich Co., with which he has been associated since 1934. He started as a chemist in the works laboratory at Akron and within a year was assigned as a technical man in the processing division. He later held technical positions in the industrial products and aeronautical divisions. In 1942, Mr. Mohaupt was named manager of compounding for the aeronautical division.

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To Make Atlas Tires

Seiberling Rubber Co., Akron, O., is completing negotiations to manufacture tires for Standard Oil Co. of Ohio under the Atlas brand name. The tires will be sold by Sohio's retail outlets.

This is reported to be the first time that Seiberling has undertaken to produce tires other than those bearing the company's name. It is expected that the recently expanded production facilities of the company will now be used to fullest advantage and that stabilization of the production picture throughout the year will result from the move.

New Safe Aire Model Tire

A new version of the Safe Aire tire is being manufactured by Sieberling, originator of the line. Constructed of all-rayon cord with a thicker white sidewall than previously used, the model is said to be the quietest high-speed tire on the road. The use of Claw Grip treads containing 264 traction slots, and of natural rubber for treads and side-walls, is claimed to result in improved anti-skid characteristics and reduced heat generation.

Heat vents which reportedly dissipate heat and break up traction waves, a new carcass compound of improved tear-resistant qualities, and a better bond between the rayon cord and the rubber are other improvements claimed for the new Safe Aire tire.

Oppose Freight Increase

The traffic committee of the National Association of Waste Material Dealers, Inc., 271 Madison Ave., New York 16, N. Y., has filed a brief to the Interstate Commerce Commission opposing the railroads' attempt to make permanent the increases that have been granted for a temporary period on freight transportation. The ICC is requested to deny the petition of the rail carriers or assign the matter to a public hearing.

Purchases Dumont Subsidiary

Calresin Corp., Arcadia, Calif., processor of compounded polyvinyl chloride hot melt materials, has purchased Poly-Fiber, Inc., Los Angeles, Calif., a reinforced plastic molding and fabricating subsidiary of Dumont Laboratories, Inc. The purchase is reported to be in line with Calresin's expansion plans in the plastic field covering hot melts, encapsulation of electronic parts, and reinforced plastic molding and fabricating.

Explosion at American Polymer

An explosion occurred at the Peabody, Mass., plant of American Polymer Corp. on April 30, killing one man and seriously injuring two others. The cause of the disaster remains unknown at this time; investigations are continuing.

Production at the Peabody facilities is expected to resume by this month. In the interim period, customers are being served by other plants of the corporation. The adjacent plant of American Resinuous Chemicals remained intact, and shipments to all customers were resumed on May 4.

Israel Tire Firm Shows Profit

Alliance Tire & Rubber Co., Ltd., Hadera, Israel, an American-Israeli joint capital and know-how venture, is functioning on a profitable basis at the end of its first year of operation. According to Arthur Taubman, company president and head of the American group of investors, the ultramodern Alliance plant began complete tire and tube production last September, only five months after dedication and one year after the firm's formation. By January of this year the operations were showing a substantial profit.

At the close of Alliance's fiscal year on March 31, the company was able to report a production rate of 3,000 tire units, or 225,000 pounds, per month, of which 85% are truck and bus tires; a total of 177 employes; a consistent increase in monthly production rate despite the need of teaching unskilled workers and the fact that 22 languages are spoken at the plant; a backlog of orders of approximately $400,000; a plant production average of about 70% of top American standards; and exclusive use of its tires and tubes by the Israeli Army after extensive comparative tests with imported makes.

A. L. Freedlander, president of Dayton Rubber Co., Dayton, O., which is serving under a 10-year contract as technical adviser to Alliance, emphasized that the achievement of the Israeli firm represents "a remarkable record inasmuch as tire and tube production requires one of the highest degrees of industrial engineering." Mr. Freedlander also declared that Alliance's tire standard and quality requirements are extremely high, and that the tires have been designed especially for Israel's high temperatures, rough roads, and desert or semi-arid conditions.

Mr. Taubman stated that tire production will continue to increase until it reaches the plant capacity of about 550,000 pounds per month. Export sales will eventually consume 50% of production. In this connection, the Israel Tire Sales Corp., with headquarters in New York, N. Y., has been set up to handle Alliance sales in the United States. Negotiations are also being conducted with other nations for export sales.

Davis-Standard Sales Corp.

Beginning this month Davis-Standard extruders and standard molding presses, manufactured by Standard Machinery Co., Mystic, Conn., will be marketed by the Davis-Standard Sales Corp., also of Mystic.

Standard molding presses were formerly sold through F. J. Stokes Co., Philadelphia, Pa., under the name of Stokes Standard molding presses. The machines and parts will now be available directly from the manufacturer through the sales corporation.

Plastex Products Co., Marietta, Ga., has changed its name to Flexible Products Co. No other changes, however, have been made in the organization.

Flek Corp., 2252 E. 37th St., Los Angeles, Calif., has been appointed exclusive warehousing distributor for Kel-F molding powders on the West Coast by M. W. Kellogg Co., Jersey City, N. J. All standard grades of the material are stocked and are available from the distributor.

Scrap Rubber Committee

Milton Kushkin, A. Schulman, Inc., recently elected president of the Scrap Rubber Institute of the National Association of Waste Material Dealers, Inc., has announced the following appointments to the executive committee of the Institute: J. J. Costello, Tanney-Costello, Inc.; Tex Lakin, A. Lakin & Sons, Inc.; Sidney Freedman, H. Muehlstein & Co., Inc.; Roger Ottignon, Nat E. Berzen, Inc.; Jerome H. Desser, Desser Tire & Rubber Co.; Dave Bettin, Commercial Metals Co.; Ben Gordon, A. Schulman, Inc.; and Irving Levin, Superior Iron & Metal Co.

Name Change to Include Plastic Scrap

Later it was announced that the Scrap Rubber Institute has become the Scrap Rubber & Plastic Institute. Officers of the SRI will continue as officials of the new organization, with their respective duties unchanged.

Pivoting Windows

A new window, designed to pivot on a vertical axis, has eliminated the danger of washing windows in tall buildings. Washing of both sides of this window, originated by Adams & Westlake Co., Elkhart, Ind., is accomplished from the inside of the building.

To achieve a dust, air, and rain excluding seal, a butyl rubber tube is constructed into a groove which circumscribes the frame midway between the outer and the inner surfaces. The window sealing rubber is then placed over the tube. Inflation of the tube to about 16 psi., performed by means of a hand pump, accomplishes the seal; deflation occurs by means of a vacuum pump and permits the free pivoting of the unit.

The rubber components were designed and manufactured by The General Tire & Rubber Co., Akron, O. Largest single user of the windows is the new skyscraper of Aluminum Co. of America in Pittsburgh, Pa.

Honor Scroll to Mark

The New York Chapter of the American Institute of Chemists awarded the 1953 Honor Scroll of the Chapter to Herman Mark, head of the division of polymer chemistry, Polytechnic Institute of Brooklyn, at the Chapter's annual dinner-meeting on May 21 at the Hotel Commodore, New York, N. Y. Principal speaker at the affair was Emil Ott, director of research, Hercules Powder Co.

New Roll Covering Plant

The Manhattan Rubber Mfg. Co., a subsidiary of Raybestos-Manhattan, Inc., Passaic, N. J., recently opened a new rubber roll covering plant in Neenah, Wis. Production facilities at the high single-story structure are laid out for straight-line operation, and special machinery for handling the largest-size rolls has been installed.

The new plant expands existing facilities for rubber covering rolls for the paper and other industries in the Midwest. Other roll covering plants of the organization are in Passaic and in North Charleston, S. C.

Executive Changes at 3M

Elevation of Herbert P. Buetow, executive vice president in charge of finance, to the presidency of Minnesota Mining & Mfg. Co., St. Paul, Minn., was announced last month. He succeeds Richard P. Carlton, who becomes vice chairman of the executive committee.

Buetow joined 3M as auditor in 1926 and became controller in 1935. He was made treasurer and a director of the company in 1939 and has been an executive vice president since 1949.

Carlton has been president of 3M since 1949. He started as a laboratory assistant in 1921 and within a short time was made responsible for quality control of all 3M products. He was elected a vice president and a director in 1929 and became executive vice president in charge of manufacturing, engineering, and research in 1948.

In announcing Buetow's election, William L. McKnight, board chairman, explained that for health reasons Carlton had asked to be relieved of the broad duties of president. In his new assignment Mr. Carlton will be free to continue his interest in research and product development.

In addition to serving as vice chairman of the executive committee Carlton will continue as a member of the board of directors and of the finance committee.

Buetow's election does not alter the status of McKnight or of Archibald G. Bush, chairman of the executive committee. McKnight, Bush, and Carlton are the men most prominently identified with the firm during its period of greatest growth.

H. N. Stevens has been elected vice president in charge of central research at 3M. Dr. Stephens was in charge of the central research laboratory since 1937. From 1927 to 1937, while an assistant professor of chemistry at the University of Minnesota, he had been a research consultant to 3M.

Celanese Buys Marco Firm

Celanese Corp. of America, New York, N. Y., has purchased Marco Chemicals, Inc., Linden, N. J. The move places Celanese in the field of low-pressure thermosetting resins for laminating, casting, coating, impregnating, and molding. An expanding line of Marco products will be manufactured at Linden as part of the plastics division of the new owner.

Personnel of the Marco organization will be retained to assist in the operations planned for the unit. Irving E. Muskat, former president and founder of Marco, will join Celanese to assist in the conduct of the newly acquired business and to help in the research and development of new and improved resins.

Adds to Sales Force

Sharples Chemicals, Inc., 123 S. Broad St., Philadelphia 9, Pa., has added two men to its sales force.

Harold L. Brown, formerly a supervisor of technical service with Plaskon at Toledo, has been assigned to the Sharples New York regional office and will cover Connecticut, Manhattan Island, and portions of New York, Pennsylvania, and New Jersey.

Norman P. Phillips, who comes from the National Aluminate Co., has been assigned to the midwestern regional office and will service Sharples customers in Ohio, Kentucky, and Tennessee, from Cleveland.

James, NPA Statistician, Retires

Herbert C. James, chief statistician of the Rubber Division of the National Production Authority, who from 1942 held the same position for the OPM, OEM, WPB, CPA, and Commerce Department rubber bureaus, retired from government service on April 23.

Ninety-six members of government and industry were present at a testimonial dinner held on that date at the Hotel 2400 in Washington, D. C. Nearly 50 representatives of the industry were in Washington for the dinner, and no less than five directors of the long succession of rubber bureaus shared the head table with "Pappy" James, dean of the rubber statisticians, on his retirement.

The five rubber directors were: Walter Krappe, director of the present NPA Rubber Bureau; E. D. Kelly, now director of the Office of Synthetic Rubber, Reconstruction Finance Corp.; L. E. Spencer, now assistant to the president, Goodyear Tire & Rubber Co.; Earl Glen, former head of the Rubber Bureau in NPA and earlier in Commerce; and W. J. Sears, now vice president of The Rubber Manufacturers Association, Inc. Letters from two earlier directors, James Clark and L. D. Tompkins, were made a part of a leather-bound, gold-trimmed testimonial document presented to Mr. James. This booklet also included letters from scores of industry friends who were unable to attend, photoflash pictures of his office contemporaries, and two scrolls signed personally by his well wishers.

The former head of the government's department on rubber statistics was also given four fine imported briar pipes and a humidor and pipe rack bearing a face plate engraved for the occasion.

Mr. James entered government service from a position as assistant to the executive vice president of United States Rubber Co. in 1929 and served with the Tariff Commission and the Securities & Exchange Commission before taking charge of rubber statistics in 1942.

Window Curtains of Velon Yarn

The Firestone Plastics Co., Pottstown, Pa., has announced the development of a new marquisette material woven of Velon yarn for use in window curtains. Curtains made of the yarn are reported to be easily washed or wiped clean, highly stain and fade resistant, and long wearing. They are also claimed to retain their crispness indefinitely. Ironing is not recommended.

The Velon curtains are being made by International Flouncing Co. in three white styles, and other colors are expected to be added later.

Paul A. Roush, senior project engineer at Flexible Tubing Corp., Guilford, Conn., has been named manager—product development of the company. A physicist and specialist in high-temperature polymers, Mr. Roush will have charge of Flexible's research, product development, and quality control activities. Mr. Roush came to Flexible Tubing after 17 years with The B. F. Goodrich Co., where for five years he specialized in studies of the mechanical properties of high-temperature polymers at the Goodrich Research Center. His work at Flexible Tubing has included engineering studies and development of the company's silicone-coated tubing.

Rubarite, Inc., Formed

The formation of Rubarite, Inc., has been announced by Goodyear Tire & Rubber Co., Akron, O.; National Lead Co., New York, N. Y.; and Berry Asphalt Co., Chicago, Ill., subsidiary of Bird & Son, Inc., East Walpole, Mass. The new company will manufacture and sell Rubarite synthetic rubber powders for use in asphalt for roads and in other asphalt materials.

Officers of Rubarite are: H. B. Pullar, Berry Asphalt, president; G. B. Coale, National Lead, vice president; and H. A. Endres, Goodyear, vice president. In addition to Pullar and Coale, the board of directors is composed of A. H. Anderson and W. C. Ahlgren, Bird & Son; R. Rowland and A. H. Drewes, National Lead; and R. S. Wilson, P. E. H. Leroy, and R. P. Dinsmore, Goodyear. General manager of the new company is Walter F. Winters, former chief engineer of the Asphalt Institute.

Rubarite is a free-flowing, unvulcanized synthetic rubber material produced by coprecipitating a synthetic rubber latex and extremely small particles of barytes. The rubber is so distributed and separated by the barytes that it readily amalgamates with asphalt, by heat, friction, or a combination of both. Use of the product reportedly does not require special equipment; the powder is easy to handle and, when mixed with asphalt, can be treated in exactly the same manner as conventional hot mixes. These mixes, however, can be rolled immediately after laying, whereas it is necessary to wait 10-30 minutes before rolling regular asphalt mixtures. Rubarite is also claimed to improve cold mixes and may be used successfully in other applications such as seal coats and crack and joint fillers.

The company is currently constructing a manufacturing plant at Magnet Grove, Ark., to produce the new product.

Chemists, Ch. E. Demand Studied

Representatives of the Bureau of Labor Statistics, United States Department of Labor, will visit selected firms in the chemical, rubber, and petroleum industries in May, June, and July in connection with a study of the factors affecting the demand for chemists and chemical engineers. The study, being conducted at the request of the Department of Defense, will attempt to determine the current and future demand for scientific personnel. Data will be collected for the purpose of planning scientific research programs and for developing policies with regard to Selective Service and reservists. Professional societies, educational institutions, and private companies are also expected to benefit from the information, little of which is currently available in adequate quantities.

Phonograph Record

J. M. Huber Corp., 100 Park Ave., New York 17, N. Y., is distributing with the current issue of its bi-monthly house organ, *Huber News*, a phonograph record on which are reproduced two famous master recordings, "Tell Me Pretty Maiden" by Vess Ossman, and "Stars and Stripes Forever" by John Philip Sousa's band. The record celebrates the fiftieth anniversary of RCA Victor Red Seal records and the Diamond Jubilee of the record industry, to which the Huber organization supplies carbon black for record manufacture.

Major Expansion in Bakelite Polyethylene

A three-year program for the expansion of polyethylene production, said to be the largest single expansion in the history of the plastics program, was announced by Bakelite Co., Division of Union Carbide & Carbon Corp., New York, N. Y. According to H. S. Bunn, Bakelite president, the program calls for the building of three large plants at Texas City and Seadrift, Tex., and Torrance, Calif., to produce the plastic, its compounds, and other chemicals from natural gas. When completed in 1955, the expansion program will bring total annual production of Bakelite polyethylene to more than 250,000,000 pounds.

Each plant is strategically located near major gas supplies in Texas and California which are the raw materials. Each of the new plants will have a rated annual capacity of 60,000,000 pounds or more of polyethylene. The plants will be built and operated by Carbide & Carbon Chemicals Co., another division of Union Carbide; while sales will be handled by Bakelite. The projected schedule calls for the new plants to begin operating, as follows: Texas City, about August of this year; Seadrift, by mid-1954; and Torrance, by early 1955.

The expansion program was announced by Mr. Bunn on May 6 during ceremonies attended by companies officials, representatives of the Armed Services, and the press. The ceremonies included a trip to Bakelite's Bound Brook, N. J., plant and a tour of the polyethylene development laboratories, followed by a luncheon, exhibit of civilian and military applications of polyethylene, and field demonstrations of new and recent military uses for the plastic. Speakers at the luncheon included Mr. Bunn; Earl D. Johnson, Under-Secretary of the Army; and Capt. W. M. Pryor, Jr., assistant chief of the Bureau of Ships, Navy Department.

In addition to announcing the expansion program, Mr. Bunn also noted that "polyethylene is not only the fastest growing plastic, but it has also had the greatest per cent price reduction of any major plastic within the last 10 years." This price decline reflects improved engineering and production techniques; one operating unit at Bakelite's South Charleston, W. Va., plant now produces at a rate equivalent to six units back in 1943.

"Bakelite polyethylene is made under the highest pressure at which any continuous commercial process is operated today, as far as is known," Mr. Bunn declared, and the solution of the many chemical and engineering problems arising from this process came from the varied knowledge and experience of the different Union Carbide divisions.

Mr. Johnson said that the military uses of polyethylene plastic exemplified the results obtained by teamwork between the military, science, and industry in the nation's research and development work. This research program resulted in the development of polyethylene insulated field wire for telephonic communication which is cheaper, easier to lay, has a 20% longer talking range, and is 66% lighter than its World War II predecessor. This one development alone will result in a savings to the Army of about 11,000 tons of steel, 1,000,000 pounds of critical copper, and $12,000,000 in purchasing costs during the coming year, Mr. Johnson declared.

After describing some of the important uses for polyethylene in the Navy, Captain Pryor forecast ever-increasing naval applications for the plastic, in addition to its great commercial potentialities, as the result of continuing research and development.

The field demonstrations of polyethylene applications included pillow balloons used to carry messages behind the Iron Curtain; giant Skyhook stratosphere balloons used by the Navy for upper-air weather research; lightweight pipe for farm water systems; flexible pipe and conduit for gas and power transmission; aerial tow targets woven from polyethylene filaments; industrial acid carboys; Army assault telephone wire that can be strung from dispensers or laid down by planes traveling at speeds of 120 miles per hour; Army Signal Corps carrier cable; and cartridge-case liners for recoilless rifles.

Opens Plant in Brazil

American Polymer Corp., Peabody, Mass., recently announced the official opening of the plant of its Brazilian associated company, Polymer Produtos Quimicos do Brazil of Sao Paulo. The complete plant was designed and constructed by American Polymer in the United States and forwarded to Brazil last June through its export department, Chemicals Export Co. Polymer Produtos Quimicos do Brazil is said to be the first all-purpose polymerization plant in South America to meet the needs for resin polymers for the leather, paint, plastic, textile, adhesive, and agricultural industry.

Building construction and equipment installation were started in July, 1952, and actual production commenced on April 6, 1953.

Frank A. Ryan, of American Polymer, has been appointed general manager in charge of production for the Brazilian company. Before joining American Polymer, Dr. Ryan was on the staff of American Research & Development Corp., Boston, Mass.

The Timken Roller Bearing Co., Canton, O., on May 7 announced a series of promotions brought about by the retirement of J. A. Riley, secretary-treasurer. H. E. Markley, assistant secretary, has been elected secretary; G. L. Deal, assistant treasurer, was elected treasurer; B. R. Powell, chief cost accountant, has been named assistant secretary; and R. A. Gulling, systems supervisor, has been elected assistant treasurer.

Harry A. Trechter

Arne W. Lunke

Albert Koper

Harwick Sales Representatives

Harwick Standard Chemical Co., Akron, O., recently appointed three technical sales representatives to its organization.

Albert Koper, who just returned from a two-year recall service as lt. commander with the U. S. Navy, has joined the company's Akron organization. Prior to his navy service he had been with The B. F. Goodrich Co., Akron, where he had started as chemist in the general chemical laboratories in 1939. Later he went to the engineering division as water and fuel chemist and in 1946 was transferred to the purchasing division as buyer of chemicals, pigments, and fabrics. While attending college he had been laboratory instructor on general and analytical chemistry. Mr. Koper is a member of the American Chemical Society and of the Akron Rubber Group.

Harry A. Trechter will be attached to the staff of Harwick's Los Angeles branch and brings to its Pacific Coast organization extensive experience in the rubber, paint, and plastics industries. He previously had been with the Gates Rubber Co., Denver, Colo., in the purchasing department for nine years. He was a cavalry officer during World War II and had been with General Mills in an administrative capacity before that. Mr. Trechter also belongs to the A. C. S., and to The Los Angeles Rubber Group, Inc.

Arne W. Lunke has been named to Harwick's Chicago staff. He was formerly with United States Gypsum Co., as buyer of chemicals and paint raw materials. Mr. Lunke is a member of the A. C. S., Rubber Division, and Chicago Section, and of the International Society of Leather Trades' Chemists and of the Norsk Garver Forening, Bunnlaers Gruppen.

Government Committee on O-Rings

Walter L. Tepper, president of Martin Rubber Co., Long Branch, N. J., has been appointed chairman of the Task Committee on O-rings. The committee is one of several advisory groups to the Defense Department which operates in cooperation with the National Security Industrial Association for the purpose of promoting research in the synthetic and natural rubber fields and for coordinating and distributing information on hand. Mr. Tepper has served for several years in an advisory capacity and as a member of NSIA's Rubber and Elastomeric Committee.

New Cabot Research Facilities

Godfrey L. Cabot, Inc., 77 Franklin St., Boston 10, Mass., commemorated the official opening of its new research laboratories at 38 Memorial Drive, Cambridge, Mass., on May 7 with an open house at which Godfrey L. Cabot, founder, president, still-active head of the company at 92 years of age, entertained university scientists, research directors, and prominent industrialists. Visitors from neighboring institutions and local companies, and families of the research staff and of the office force, were guests on May 8 and May 10, respectively. The new facilities, which supplement other research laboratories of the company at Pampa, Tex., and at Cambridge, will perform fundamental as well as practical research, evaluation, and control of Cabot products plus techical service to customers. A 26-page booklet describing the various sections of the new unit has been published by the company to acquaint the industry with the facilities of the laboratory.

The new research center consists of one structure, four stories high, with 26,000 square feet of floor space. The nine separate laboratories present contain facilities for compounding, physical testing, pigments application, ceramics, organic, analytical, electron microscope, and physical research, as well as a two-story pilot-plant unit of 1,500 square feet area. Some of the equipment contained in the labs includes Banbury mixers, laboratory roll mills, curing presses, ball and roll mills, and a variety of high- and low-speed mixing equipment for preparing dispersions of all types. The top floor of the building houses air-conditioned administrative offices; consultation, conference, and first-aid rooms; a coffee shop; and a library. The entire structure is designed to provide maximum flexibility and convenience of operation, and opportunity for future expansion.

The company, founded in 1882 by Dr. Cabot, manufactures all grades of carbon black required by the rubber industry, from the fine particle-size oil furnace and gas channel blacks to the coarse particle-size gas furnace blacks. The company has also extended its interests to the manufacture of plasticizers, pine-tar products, coke, charcoal, wollastonite, clay, natural gas, natural gasoline, gun tubes, and oil well pumping equipment.

Louis Cabot, Willard Smith Promoted

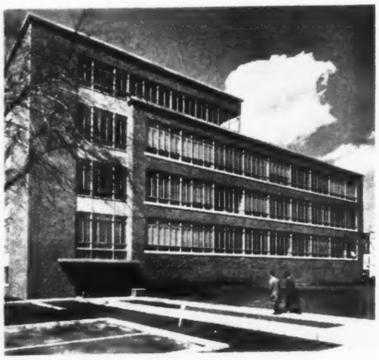
The Cabot company last month also announced the election of Louis W. Cabot as vice president and treasurer to succeed Ralph Bradley, who resigned May 1. Mr. Cabot is a grandson of the founder of the company and until recently was resident in England as managing director of Cabot Carbon, Ltd., British subsidiary of the Boston company. Mr. Bradley has been an officer of the company since 1929 and will continue in a part-time capacity and as a member of the board of directors.

Willard P. Smith, with Cabot for 26 years, has also been elected vice president. He has been eastern production manager in charge of natural gas operations in the Appalachian area for the past five years and will continue in that field of operations in his new capacity as vice president

Godfrey L. Cabot Honored

Dr. Cabot was named "Grand Old Man of the Natural Gas Industry" and honored at the May 14-23 International Petroleum Exposition in Tulsa, Okla. He was presented an inscribed gold medal by B. L. Majewski, president of Great American Oil Co., in a commemorative ceremony held near the Drake Well replica on the exposition grounds on May 17. Dr. Cabot was one of seven pioneers representing industry divisions selected by the IPE "Old Timers" committee to receive an award, a practice initiated at the 1927 Tulsa exposition. Dr. Cabot is also well known as a philanthropist and patron of science.

Attending Official Opening of Cabot Research Center are *(Left to Right)* Louis W. Cabot; Godfrey L. Cabot; and Thomas D. Cabot, Executive Vice President



Cabot Research Laboratories

Court Action on Tubeless Tires

A lawsuit has been filed in the United States District Court, Cleveland, O., by The B. F. Goodrich Co., Akron, O. charging that the Firestone Tire & Rubber Co., also of Akron, is and has been infringing patents of Goodrich in the manufacture and sale of tubeless tires for motor vehicles and aircraft. Enjoinment against further infringements and damages for past infringements of Goodrich patents are asked for the company.

Firestone is expected to defend its position with the contention that Goodrich did not originate the idea of tubeless tires, that Firestone has independently pursued its own development in this field without appropriating anything covered by patents, that its product contains features unique to Firestone, and that its tubeless tires are superior to those of Goodrich.

Firestone states that it has in the past successfully fought two similar law suits in which the company was charged with patent infringements on a tire building machine and on a tire building method. In both cases the court decided that the patents were invalid and dismissed the suits.

Dow Corning Tenth Anniversary

Dow Corning Corp., Midland, Mich., celebrated its tenth anniversary on May 7 and 8. The company reported that during the first eight years its productive capacity was doubled, redoubled, and doubled again, and that it is now well into a new expansion program which will quadruple facilities for making silicone products.

As part of this anniversary celebration, Dow Corning held an editorial press conference at Midland. A new Silastic plant, a new methyl chloride plant, and a new 6,000 kva electric furnace plant for producing silicon from quartz rock and coke were available for inspection. Also, a new plant built for Dow Corning in Germany for making silica pigment was mentioned. This pigment contributes much to the superior physical and electrical properties of Silastic, it was said.

New silicone rubber products exhibited were a new magnet wire enamel, two new Class H varnishes, and a new silicone bonding resin with three to 100 times the dielectric life of the earlier silicone varnishes and resins. A demonstration showed how Silastic R tape is applied and vulcanized to form void-free and resilient Class H insulating jackets for preformed coils.

Of interest to engineers in the automotive, aircraft, and electrical industries are two new Silastic stocks that are much easier to fabricate and have a combination of properties engineered to give long and reliable service in most mechanical and electrical applications.

A silicone resin which can be foamed in place to form a lightweight cellular structure that will withstand direct contact with the flame of a blow torch and which then retains its physical strength at temperatures in the range of 400 to 500° F. was mentioned. Also discussed were silicone resins for low-pressure laminating and silicone molding compounds.

DeCetex Emulsion for the textile industry was reported as the most durable water repellent finish for synthetic fabrics and blends. A silicone water-repellent treatment for leather and a water-soluble polysiloxane salt that has interesting possibilities were also demonstrated.

Silicone adhesives for pressure-sensitive tapes that have very high adhesive strength in contact with a wide variety of surfaces and at both high and low temperatures were included in the new developments discussed.

A visit to the Dow Chemical Co. plant at Midland with opportunity for discussion with heads of Dow's magnesium, general chemicals, plastics, or agricultural chemicals departments was also provided.

Emery Sales Meeting

A meeting of the nation-wide chemical sales representatives of Emery Industries, Inc., Carew Towers, Cincinnati, O., was held recently in Cincinnati. Highlight of the week-long conference was the awarding of 16 prizes for sales promotion and advertising ideas. The first four awards, respectively, were given to D. R. Eagleson, of the Chicago office; F. L. Ekstrand, Philadelphia; L. J. Hodobas, Los Angeles; and H. D. Armitage, New York.

The meeting included technical sessions at which sales experiences were related and new data on the company's products were distributed. The group also visited the nearly completed ozone-oxidation plant of the company, where diabasic azelaic acid and monobasic pelargonic acid will be produced.

When ordering GR-S Rubbers specify polymers extended with Sundex-53 and Circosol-2XH

Sundex-53 and Circosol-2XH offer you the assurance of polymer uniformity, plus the advantages of the most favorable physical characteristics of the finished vulcanization. Minimum downgrading of the polymers takes place during compounding and long storage of raw polymers when these two Sun products are used as extenders.

SUNDEX-53 is a relatively aromatic process aid. Its plasticizing action provides good processing in Banbury and mill mixing. Sundex-53 is highly compatible with natural rubber, GR-S, reclaims and all combinations of these three.

Oil masterbatch polymers containing Sundex-53

New Number	Old Number	
X-740	X-712	25 parts Sundex-53, 50/50 rosin/fatty acid emulsified
X-743	X-713	25 parts Sundex-53, rosin acid emulsified
X-737	X-716	37.5 parts Sundex-53, 50/50 rosin/fatty acid emulsified
X-724		37.5 parts Sundex-53, rosin acid emulsified

CIRCOSOL-2XH is a relatively naphthenic process aid. Its plasticizing action is not quite as great as that of Sundex-53. However, its nonstaining characteristics permit wider application. With small amounts of peptizers, Circosol-2XH provides desirable processing stocks.

Oil masterbatch polymers containing Circosol-2XH

New Number	Old Number	
X-738	X-628	25 parts Circosol-2XH, 50/50 rosin/fatty acid emulsified
X-745	X-693	25 parts Circosol-2XH, 50/50 rosin/fatty acid emulsified; nonstaining
X-747	X-717	37.5 parts Circosol-2XH, rosin acid emulsified
	X-718	37.5 parts Circosol-2XH, fatty acid emulsified
X-735	X-722	37.5 parts Circosol-2XH, rosin acid emulsified; nonstaining

Oil black masterbatch polymer containing Circosol-2XH

New Number	Old Number	
X-746	X-629	25 parts Circosol-2XH, 50 parts HAF carbon black

For more information about Sundex-53 and Circosol-2XH, write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. RW-6.

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

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Textile Mill Expansion

Ground will be broken this summer for a major expansion of Shelbyville Mills, Shelbyville, Tenn., a textile mill of the United States Rubber Co., Rockefeller Center, New York 20, N. Y., which produces tire chafer fabric, tufting yarns, and rayon tire cord. The construction is expected to start early in 1954 and will consist of a one-story addition to the main mill building. This second major expansion of the plant within the past two years is expected to add approximately 200 persons to the 750 presently employed at the mill.

Vinyl Equipment Purchased

U. S. Rubber has purchased one of the country's largest modern vinyl calenders and auxiliary equipment. The 28- by 66-inch four-roll calender and the equipment will be installed in the company's Mishawaka, Ind., plant for use in the production of Elastic Naugahyde vinyl plastic upholstery.

Management Fellowship for Women

U. S. Rubber has awarded \$3,500 to the Management Training Program at Radcliffe College, Cambridge, Mass., to be used for one fellowship of \$700 each year for the next five years. The Program, now in its sixteenth year, is a one-year graduate course in personnel and business administration.

The company has made other contributions to the college in this respect. For the past two years it has granted one-year fellowships of \$700 each, and many students enrolled in the program have been placed in company positions for field work assignments over the last decade.

Executive Personnel Changes

Albert M. Stover, formerly manager of Marvinol plastics development, has been appointed assistant to the director of research and development of Naugatuck Chemical Division, according to Earle S. Ebers, director of research and development. Mr. Stover will work principally on the development of new products and will report directly to Dr. Ebers. Mr. Stover has been with the Division since 1949, when the chemical division of Glenn L. Martin Co. was purchased by Naugatuck Chemical. At Glenn L. Martin, Mr. Stover had been director of development for the chemical division. He is a member of the American Chemical Society, American Institute of Chemical Engineers, Society of Plastic Industry, and a former vice president of the Baltimore-Washington Section of the Society of Plastic Engineers.

Raymond A. Herrly has been appointed plant manager of the company's new foam rubber manufacturing plant to be built in Santa Ana, Calif. Since manufacturing operations there are scheduled to start late this year, Mr. Herrly will continue for a few months at the Mishawaka, Ind., plant, where he has been manager of industrial engineering for three years. Mr. Herrly started with U. S. Rubber 14 years ago as a control chemist in foam rubber at Mishawaka, where he later progressed to the position of foam superintendent. During World War II, when foam rubber could not be manufactured, he served as assistant superintendent of fuel cell production and as superintendent of plastic board production.

Herbert J. Reid, formerly production superintendent of the Gilmer belt plant in Philadelphia, Pa., has been named assistant to the production manager, W. A. Armstrong, mechanical goods division. Mr. Reid started with the rubber company in 1931. His headquarters will be at the general offices in Rockefeller Center.

Chester M. Boehm has been named manager of sales policy, mechanical goods division. Mr. Boehm, former assistant manager of the sales operating department for the same division, has been with the company since 1920. His new activities will cover all hose and belting items except V-belts. His headquarters will remain in Rockefeller Center.

Mesh Marked Golf Balls

U. S. Rubber has introduced a new mesh marked golf ball with an electronically sealed plastic covering that protects it until it is played. True flight and uniform performance of the ball are said to result from use of a silicone center and electronic winding, and a tough, fully cured Cadwell cover inhibits cutting and scuffing.

Modern painting is said to make the ball look and stay whiter. The new ball conforms to the specifications for tournament balls and is marketed in the company's Royal Special, Royal (Blue), and True Blue brands.

Tire Matching Device

A new dual tire matching caliper for trucks has been announced by U. S. Rubber. This tool may be used for proper matching when new tires are being installed or when tires are being rotated. Also, where a trucker stocks recapped or repaired tires, he can identify them by measurement for ready reference when matching them with the tires on his trucks.

Golf Ball Cover

The marketing of U. S. Royal golf balls, product of U. S. Rubber, in a new Plasti-Guard package has been announced. The cover, formed of two plastic hemispheres electronically sealed together, is expected to protect the individual balls from dirt before they are played.

Rubber Surfaced Road

A 1½-inch layer of material composed of asphalt and Surfa-Sealz, a plasticized synthetic rubber compound made by the Naugatuck Chemical Division, Naugatuck, Conn., has been applied to a 4½-mile stretch of New Jersey highway. The compound, applied over a 1½-inch thickness of binder material, is expected to form a durable, smooth, safe surface which may double the life of the road and virtually eliminate maintenance.

The rubber reportedly acts as a binder for the asphalt, preventing water from seeping into the pavement and buckling and cracking the road when it freezes. The compound was transported in the hot-mix stage and mixed by the contractor prior to application. It is estimated that 6,600 tons of the rubber paving compound and approximately six working days were required for paving the stretch.

Conveyor Belts in Coal Mines

George C. Crabtree, belting manager, mechanical goods division, United States Rubber, stated at the recent American Mining Congress Coal Show at Cleveland, O., that an estimated 90% of all underground production of coal in this country is now mechanically loaded. Figures given indicate that the amount of coal output loaded on conveyor belts rose almost 11% between 1950 and 1951.

This increased use of heavy-duty conveyor belts which reportedly speeds production and cuts costs may be partly attributed to the use of nylon, rayon, and other synthetic fibers to improve the quality of the belts. For example, high strength and crosswise flexibility are said to be obtained using a belt fabric called Ustex-nylon, composed of chemically treated high-strength cotton yarn and nylon fiber. Use of this material permits incorporation of a greater number of fabric plies, resulting in an increase of the overall belt strength by as much as 250%.

Tension Tape Distributor

The company has appointed Novelty Bias Binding Co., Chelsea, Mass., as a distributor of its pliable rubber tape, known as U. S. Tension Tape. The distributor will sell mainly to the garment industries and to manufacturers of ironing board covers.

Plans Isocyanate Plant

Monsanto Chemical Co., St. Louis, Mo., has announced plans to construct facilities for the production of isocyanates. The increasing demand for these chemicals, particularly in the manufacture of new synthetic rubbers and isocyanate based foamed-in-place plastics, influenced the company in its decision. Location of the plant has not been announced.

Expands Phenolic Resin Production

Monsanto also announced plans for a 15% increase in phenolic resin production at its plants in Springfield, Mass., and Port Plastics, O. The expansion, said to be the third this year, is reported to be a result of widening markets for this type of plastic in the shell molding and laminating fields, and of increased sales on the part of Monsanto to the various industries using the plastic.

News Appointments

The appointments of the following four staff engineers to the positions of assistant directors of Monsanto's general development department, of which they were staff members, were announced, May 8: Robert H. Kittner, C. Rogers McCullough, David S. Weddell, and Robert York Jr.

Donald H. Kocher has been promoted to branch manager of the Detroit sales office of the plastics division. Kocher, who joined Monsanto in 1946, was first employed at the plastics division's Springfield headquarters. The following year he was assigned to the Detroit office as technical sales representative for surface coating resins. He became assistant branch manager there in October, 1952.

Silicone Rubber Parts

The Republic Rubber Division of Lee Rubber & Tire Corp., Youngstown, O., is currently fabricating silicone rubber into all types of molded and extruded shapes. Properties given for this material, claimed to be capable of usage where common forms of rubber have been excluded, include: excellent resistance to chemical extremes; an inert surface which minimizes sticking; unaffected by weather, oils, common chemicals, and weak acids; and odorless and tasteless.

Made-to-order GR-S latices—man-made by Naugatuck

Naugatuck Chemical's proven GR-S latices—man-made in its synthetic plant at Naugatuck, Connecticut—can be tailored to your *specific needs* to bring new *versatility* to your manufacture, new *performance* to your product.

Produced by the pioneer in synthetic latex and developer of more new varieties of synthetic rubber than all other laboratories in the industry—they include the first "cold" synthetic latex to approach traditional latices in service and wearing qualities.

Naugatuck GR-S latices can be used to extend or substitute for natural latex in tire cord, foam sponge, carpet and upholstery backing, adhesives, general paper treatment, shoe soles, practically *all* latex applications.

Whatever *your* latex application, you can bet Naugatuck has the GR-S latex you need. For further information on GR-S latex and its most recent developments, write, on your letterhead, to address below.

Naugatuck Chemical

136 ELM ST., NAUGATUCK, CONNECTICUT
Division of United States Rubber Company

BRANCHES: Akron • Boston • Charlotte • Chicago • Los Angeles • Memphis • New York
Philadelphia • **IN CANADA:** Naugatuck Chemicals, Elmira, Ontario

Vote Stock Changes

The B. F. Goodrich Co., Akron, O., recently held its annual stockholders' meeting in New York, N. Y., at which they voted to amend the company's Certificate of Incorporation to eliminate 18,355 shares of preferred stock, and the provisions relating to preferred stock, and also voted to change the authorized shares of common stock, without par value, both issued and unissued, into the same number of shares of common having a par value of $10 each.

It was also voted to increase by 100,000 shares the number of authorized and unissued shares of the company's common stock which may be allotted under the Key Employes' Stock Purchase Privilege Plan approved by shareholders in 1947.

The following Goodrich directors were reelected for three-year terms, at the annual meeting: Paul C. Cabot, A. B. Jones, Barry T. Leithead, and Sidney J. Weinberg.

Erecting New Distribution Center

A new one-story brick and steel major distribution center is being erected for the Goodrich company on Indianola Ave. near the northern city limits in Columbus, O. Goodrich has taken a long-term lease on the new building, which will be owned by a private investor.

This distribution center is being built according to designs and specifications drawn up by the company's store design and engineering department. The structure is being built on a 10-acre plot of land and will occupy 200,000 square feet of space, making it the largest Goodrich distribution center in the country. Approximately 12,000 square feet will be devoted to modern, air-conditioned offices.

Big Four Railroad trackage will permit the unloading of 12 railroad cars and 15 trucks at one time. The building will be completely palletized and will utilize the latest materials handling equipment. Ground for the new building was broken May 4, and it is expected to be ready for occupancy by early December.

When completed, the center will be staffed by approximately 150 people. It will stock tires, tubes, industrial products, toys, auto and home supplies, and Koroseal products and will provide overnight service to parts of Pennsylvania, Ohio, West Virginia, Kentucky, Indiana, and Michigan.

During the past three years Goodrich has completed 11 major distribution centers throughout the country and occupied the latest of these at Seattle a few weeks ago. Another is currently under construction at Los Angeles.

Conveyor Belt Patented

A patent covering a new conveyor belt designed to carry hot materials has been issued to the Goodrich company. The construction of the belt features a nylon cord breaker embedded in the thick rubber cover. The function of the extensible, heat-resistant cords is to reinforce the rubber cover and stretch with it when the belt is flexed as it passes over a pulley. This construction, it is said, will resist formation of transverse cover cracks caused by heat and prevent the penetration of such cracks to the carcass and, in this way, extend the service life of the cover.

Eldon H. Henderson, president of Yale Rubber Mfg. Co., Sandusky, Mich., has been elected a director of Michigan Mutual Liability Co., Detroit.

Rubber for Mobile Dock Barge

Rubber components for the new mobile dock barges being used by the Army are being manufactured by The General Tire & Rubber Co., Akron, O. The units, originally designed and built by Delong Engineering & Construction Co. for off-shore drilling purposes, can be used as cargo carriers and then converted into 12-caisson docks. Several docks, each measuring 300 by 90 feet, can be welded together into correspondingly larger units.

General's rubber parts for the dock barge include huge grippers and flat-bags for installation in the pneumatic jack which permits lowering and raising the 800-ton barge platform.

Refrigerator Unit

General Tire is manufacturing a rubber cup to be used in making ice-circles in the new Servel Ice-Maker refrigerator. A measured amount of water flows into the cup and then, under pressure, into the ice making chamber of the refrigerator. The cup is made of specially compounded crude rubber that will not impart any taste or odor to the water, it is claimed.

Neikirk Succeeds Harris

Jonathan N. Harris, since 1931 controller of Dewey & Almy Chemical Co., Cambridge, Mass., became a consultant to the treasurer of the company on June 1.

Waldo W. Neikirk, assistant treasurer, assumed the duties of controller.

The change in Mr. Harris's duties was made to enable him to fill his outside engagements and begin setting up a consulting service, which he plans to continue after he retires in 1955 in accordance with the company's retirement plan.

Mr. Neikirk joined Dewey & Almy in 1948. Prior to that time he had held positions with H. H. Robertson Co. and First Boston Corp.

Houdry Dehydrogenation Process Available

Houdry Process Corp., Philadelphia, Pa., has announced the general availability of its dehydrogenation process which has been used successfully in the production of aviation gasoline and synthetic rubber intermediates. Among the more important applications of the process is the conversion of butane to butylenes and butadiene, the latter of which is the basic ingredient for GR-S rubber.

In the Houdry process, vaporized light paraffins are dehydrogenated to olefins and diolefins by passage over catalysts of the chromic oxide-alumina type. High conversion of the saturated compounds is reportedly obtained.

The present shortage of butylenes has necessitated allocation of available supply between producers of rubber and gasoline. Consequently availability of this process is expected to attract much attention from these industries.

Thiokol Chemical Corp. is the new name for Thiokol Corp., 784 N. Clinton Ave., Trenton 7, N. J. According to the company, no change in activities is involved in the name change.

Tubeless Tires at Firestone

The Firestone Tire & Rubber Co., Akron, O., has announced the attainment of its goal to provide tubeless tires for every form of transportation. The program, which began with the development in 1950 of the Supreme puncture-sealing tubeless tire for passenger cars, was recently completed with the marketing of tubeless tires for farm vehicles, trucks, and airplanes. Lighter weight, easy changing, elimination of annoying and expensive tubes, and adaptability to lighter-weight rims are advantages claimed for these tires over the conventional types with tubes.

No Low Priced Tire

A report that major tire manufacturers were expecting to introduce a third-line tire to the market in May was answered by an announcement by Firestone that it has no plans at present for marketing a lower priced tire.

Firestone Dealers Meet

The annual spring meeting of Firestone dealers, associate dealers, and store managers of the New York district was held recently at the Pelham-Heath Inn, Bronx, N. Y. The attending group of more than 200 saw the 1953 line of the company's tires, home and auto supplies.

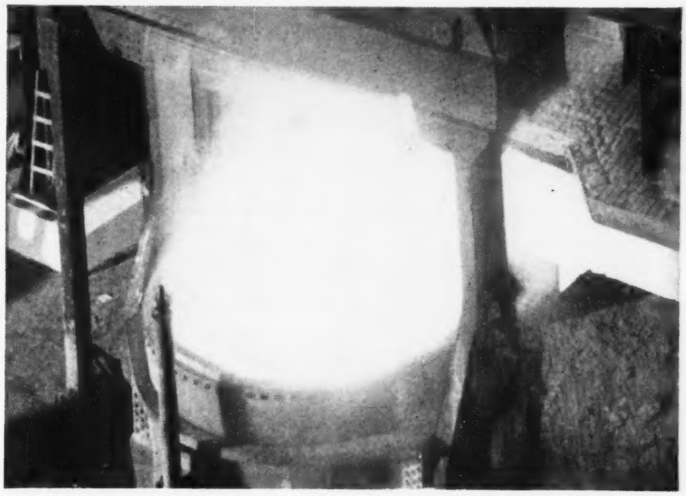
Supply Contracts Awarded

Armed Services Textile & Apparel Procurement Agency, 111 E. 16th St., New York 3, N. Y., recently reported the awarding of the following contracts, for: *men's high five-buckle fastening rubber overshoes*, to La Crosse Rubber Mills Co., Inc., La Crosse, Wis., for 115,716 pair, value, $356,154.18; *firemen's rubber boots*, 13,638 pair, $101,243.97, to Hood Rubber Co., Watertown, Mass.; *water vaporproof barrier material*, Acme Backing Corp., Brooklyn, N. Y., 1,100 rolls, $55,143; *acid-resistant rubber gloves*, 18,662 pair, $21,497.40, United States Rubber Co., Providence, R. I.; *solvent-resistant rubber gloves*, 2,682 pair, $3,486.60, Pioneer Rubber Co., Willard, O., and 2,682 pair, $4,237.56, Surety Rubber Co., Carrollton, O.; *standard divers dresses*, 138, $11,195.25, Hodgman Rubber Co., Framingham, Mass.; *rubber gloves*, 1,982 pair, $23,568.21, Morse Diving Equipment Co., Boston, Mass.; *rubber-coated aprons*, 5,904, $14,937.12, U. S. Rubber, Washington, Ind.; *hospital-bed protective drawsheets*, 141,744, $352,942.76, Archer Rubber Co., Milford, Mass.

Hershberg Products Co., Inc., Ashtabula, O., has changed its name to Hershberg Rubber Products Co., Inc., to indicate clearly the nature of products manufactured.

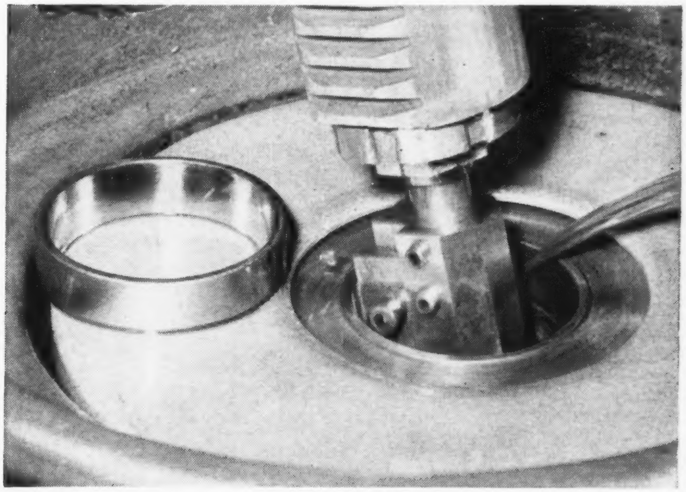
Paul A. Fodor, Jr., has been sworn in as chief of the Inorganic and Agricultural Chemical Branch, Chemical Division, National Production Authority, Washington, D. C. Mr. Fodor, district sales manager at Philadelphia for Columbia-Southern Chemical Corp., is on leave from the corporation during his temporary services with the government. During this time the affairs of the Philadelphia district sales office will be administered by **C. T. Robertson,** who is serving as acting manager.

FROM START . . .



WE MAKE OUR OWN STEEL to insure top quality from start to finish. The special grade alloy steels which give Timken bearings their strength and resistance to wear are made in our own steel mills.

TO FINISH . . .



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TIMKEN® bearings are the only bearings that give you all these advantages: advanced design, precision manufacture, rigid quality control, special analysis Timken steels. That's why you should be sure that the tapered roller bearings you use are Timken bearings. Always look for the trade-mark "Timken" stamped on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ont. Cable address: "TIMROSCO".

TIMKEN

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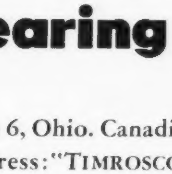
TAPERED ROLLER BEARINGS



NOT JUST A BALL NOT JUST A ROLLER THE TIMKEN TAPERED ROLLER BEARING TAKES RADIAL AND THRUST LOADS OR ANY COMBINATION

NEWS ABOUT PEOPLE

Joseph G. Cullen

Joseph G. Cullen has been appointed technical sales representative in New England for Marbon Corp., Gary, Ind. He previously had been purchasing agent and assistant to the president of Beebe Rubber Co., Nashua, N. H., and has also served on advisory committees for Elastic Colloid Corp. and the Rubber Heel & Sole Institute. Mr. Cullen, moreover, is a member of the Boston Rubber Group and the Rhode Island Rubber Club.

Martin E. Conroy has joined the technical sales staff of the chemical manufacturing division of The M. W. Kellogg Co., Pullman, Inc., subsidiary. He has been assigned to market development of Kel-F trifluorochloroethylene polymer molding powders, waxes, greases, oils, and dispersions, which are used in the electrical, electronic, chemical, and equipment industries. Mr. Conroy joins Kellogg after 4½ years with the chemical division of General Electric Co. as technical service representative. While there he was associated with product development of alkyd resins, plasticizers, silicones, and phenolic intermediates.

George W. Blair, formerly development manager of United States Rubber Co.'s footwear and general products division, retired April 30 after more than 41 years of service with the company. His primary interest was the development and commercialization of new products, including foam rubber, and he is a co-inventor on several foam rubber patents. Mr. Blair also directed development and sale in the early 1930's of a new-type contour automobile floor mat and in 1940 spearheaded development of rubber fuel cells for military and civilian airplanes. During World War II, Mr. Blair directed development of V-Board, radomes, Flotofoam, and large storage tanks for gasoline, oil and water. New civilian products resulting from wartime development include Royalite and Satusply. Early development of sponge rubber underpadding for carpets was also under his direction. Since Mr. Blair started with the rubber company in 1911 as a chief engineer, he has pioneered in new products in plastics, as well as in natural and synthetic rubber.

D. L. Van Horn has been signed by The Baker Castor Oil Co., 120 Broadway, New York 5, N. Y., to direct its program of castor bean breeding and seed production. Dr. Van Horn, who most recently was in charge of the United States Department of Agriculture's agronomic research on castor beans, will be headquartered in the Texas High Plains at Plainview.

Walter J. Gruber has joined the Chicago plant staff of Witco Chemical Co., 260 Madison Ave., New York 16, N. Y., and will supervise the manufacture of paint driers and will also be engaged in technical service on these products. Mr. Gruber comes to Witco from McGean Chemical Co.

Archie E. Albright, Jr., is now assistant to Hans Stauffer, executive vice president of Stauffer Chemical Co., 420 Lexington Ave., New York, N. Y. Mr. Albright formerly was with the law firm of Patterson, Belknap & Webb.

Archie E. Albright, Jr.

Robert S. Ames, head of canopy and laminates operations at Goodyear Aircraft Corp. since inception of the program in 1945, has been awarded an A. P. Sloan Fellowship to take part in the executive development program, School of Industrial Management, Massachusetts Institute of Technology, Cambridge, Mass. His studies will cover a one-year period.

Michael J. Batenburg has been appointed to the position of general advertising manager, and **Richard W. Dittmer** has been named assistant director of public relations for Pittsburgh Plate Glass Co., Pittsburgh, Pa. Both positions are newly created.

Kenneth C. Oestreicher has been appointed a development engineer in the laboratory of Flexible Tubing Corp., Guilford, Conn. A rubber and plastics specialist, he will be assigned to development work on special tubing coatings. Previously he had been a project engineer with Raybestos-Manhattan Co. and before that, a chemist with Seamless Rubber Co.

Robert I. Wishnick, president of Witco Chemical Co. and a trustee of Illinois Institute of Technology, was presented the Service Award at the recent Annual Alumni Reunion Dinner for his work as an alumnus in the interest of IIT. Mr. Wishnick, a founder of the Alumni Fund, has served continually on the special gift committee of the Fund and has served also as an alumni counselor on the new student program.

John W. Sproul, sales manager of golf balls at United States Rubber Co., has been reelected president of the Golf Ball Manufacturers Association for one year, from April, 1953, to April, 1954.

F. M. Galloway has been elected vice president in charge of research and development, Quaker Rubber Corp., division of H. K. Porter Co., Inc., Philadelphia, Pa. Mr. Galloway, who joined Quaker in 1933 as assistant chemist, has been, successively, chief chemist and technical superintendent. He has also been a member of the board of directors of Quaker since 1947. Before coming to Quaker, Mr. Galloway had been with Master Tire & Rubber Co. He is a member of the American Society for Testing Materials, the American Chemical Society and its Division of Rubber Chemistry, as well as a technical committee of The Rubber Manufacturers Association, Inc.

R. M. Wallace has been loaned by Phillips Chemical Co., Bartlesville, Okla., to the Office of Synthetic Rubber, Reconstruction Finance Corp., Washington, D. C., to serve as assistant chief of the Plant Operations Division, beginning May 12.

C. G. Travers joined U. S. Rubber Reclaiming Co., Inc., Buffalo, N. Y., March 1, as manager of industrial and public relations activities. For the past 20 years he was district sales manager and manager of industrial relations for Hewitt-Robins, Inc. Previously he had served in various sales and production positions with New York Rubber Corp. and Garlock Packing Co.

C. G. Travers

John R. Burkett, since 1946 assistant to the manager, dyestuff sales, American Cyanamid Co., Calco Chemical Division, will manage the business of the Calco Chemical Division in Canada, North American Cyanamid, Ltd., effective July 1. Burkett joined Calco as a student trainee, serving in the production, purchasing, and sales departments.

Arthur M. Brewer has returned to the engineering staff of Automotive Rubber Co., Inc., Detroit, Mich., which he had joined at the close of World War II. He spent the two following years as a sales engineer, working extensively in the electroplating field; he specialized in rubber applications to plating equipment. With the opening of the Korean conflict, Brewer was recalled to active duty; he saw 27 months of service. Having resumed his association with Arco on April 10, Brewer is devoting his time in developing a variety of fields for protective rubber applications.

W. A. Boudry and **Clark E. Hixson** have been appointed senior staffmen to the Goodyear Tire & Rubber Co.'s Pliofilm sales department. Boudry, with Goodyear since 1946 as a field representative in the Pacific Coast district, will be in charge of promotion and sales of Pliofilm for packaging operations in self-service meats. Hixson, who first joined Goodyear in 1948 and most recently was a Pliofilm field representative in Cincinnati, will be contacting converters and distributors of Pliofilm in the 48 states.

Thomas A. McCoy, factory manager of the Port Neches, Tex., plant of Naugatuck Chemical Division, United States Rubber Co., has been elected chairman of the Sabine Area Chapter, Texas Manufacturers Association.

J. F. D. Rohrbach, president of Raybestos-Manhattan, Inc., Passaic, N. J., was chosen from the alumni of his decade at New York University, School of Commerce, as the recipient of the John T. Madden Memorial Award, made annually to three graduates for "outstanding achievement in business, industry, or professional life." The presentation of a gold medal and a certificate was made at the annual dinner, April 30, attended by several hundred alumni and friends.

Harvey S. Firestone, Jr., chairman of Firestone Tire & Rubber Co., Akron, O., has been appointed chairman of United Nations Week, 1953, to be held October 18-24 by the American Association for the the United Nations. The eighth annual observance is sponsored by the AAUN in cooperation with approximately 100 national organizations in the interest of building informed public opinion on behalf of the UN.

Frederick L. Patton, vice president of The Cambridge Rubber Co., Cambridge, Mass., will act as general vice chairman of the twenty-second annual meeting of the Controllers Institute of America, to be held September 27-30, in the Hotel Statler, Boston, Mass.

Wentworth T. Howland, comptroller for The Boston Woven Hose & Rubber Co., Cambridge, will serve as vice chairman of the business show committee.

H. D. Allick has been assigned to the New England district staff of The Goodyear Tire & Rubber Co.'s chemical division. He will headquarter in Boston and service Pliovic vinyl resin accounts, assisting them in the use of Goodyear's new polyvinyl chloride series of resins. Allick, who recently completed seven months of specialized training in Goodyear's development laboratories in Akron, has been with the company since October, 1952. He has had previous experience in technical service and development compounding.

W. Fred Anderson has joined Boston Woven Hose & Rubber Co., Cambridge, Mass., as product manager of the hose department. Anderson formerly had been associated for 12 years with The B. F. Goodrich Co., Akron, O., where most recently he was in sales development of industrial hose.

Emil Ott, director of research for Hercules Powder Co., Wilmington, Del., has been elected president of the American Section of the Societe de Chimie Industrielle. The parent society is sponsoring the twenty-sixth International Congress of Industrial Chemistry to be held in Paris in June of this year.

CANADA

Rubber Association Elects

The Rubber Association of Canada at its annual meeting on May 15 in Toronto, Ont., elected as president R. C. Berkinshaw, Goodyear Tire & Rubber Co. of Canada, Ltd., to succeed C. C. Thackray, Dominion Rubber Co., Ltd. Other officers elected were: W. H. Funston, Firestone Tire & Rubber Co., vice president; J. R. Belton, Gutta Percha & Rubber, Ltd., treasurer; and G. B. Smith, secretary and assistant treasurer. The following directors were also elected in addition to the officers and Mr. Thackray: J. P. Anderson, M. L. Brown, John W. L. Miner, J. D. Morgan, and I. G. Needles.

The meeting heard predictions by Mr. Thackray that record-high production by the Canadian rubber industry can be expected this year and that more intensive competition within the industry is probable. Mr. Smith reported that more synthetic and less natural rubber was used in the production of rubber goods in Canada in 1952, as compared to 1951. He said that consumption of new rubber amounted to 67,090 long tons, some 3,700 tons less than the record year of 1951. Of the total, consumption of natural rubber fell from 62% in 1951 to almost 50% in 1952.

Dow Expanding Facilities

Construction of a synthetic latex unit at Sarnia, Ont., by Dow Chemical of Canada, Ltd., will begin early this month. Cost of the unit, which is expected to be in production by 1954, is reported to be in excess of $1,000,000.

It is also reported that the new styrene monomer unit at Sarnia is now on stream.

Rubber Trade Down

Greig B. Smith, manager and secretary of the Rubber Association of Canada, reviewing the Canadian rubber market, reported total sales of 5,024,822 tires in 1952, 9% higher than during 1951. Domestic sales of footwear, waterproof and canvas, at 14,424,126 pairs, however, were down 2%. Principal standard production items of mechanical goods, belting, hose and packing, showed substantial decreases from the high levels attained in 1951, Mr. Smith declared. The premium on Canadian funds has been a handicap to the export trade, he added.

Mr. Smith further reported that exports fell off sharply from the high level of $29,067,215 reached in 1951 to $17,690,727 in 1952.

"The trend," the report noted, "was still down during the first few months of 1953, and there is little reason to expect it to change during the balance of the year."

Long-standing influences on the export market include restrictions on dollar imports in the sterling area, the continued expansion of rubber manufacturing in markets previously supplied from Canada, and competition from cheap Asiatic and European goods.

Two additional factors were present last year, according to Mr. Smith. They were (1) removal of restrictions on rubber consumption in the United States, "which undoubtedly invigorated United States competition in export markets," and (2) the rise in the exchange value of the Canadian dollar to a premium over the U. S. dollar.

Phillips Works Sold

The rod mill and wire and cable business of Phillips Electrical Works, Ltd., Brockville, Ont., has been sold to British Insulated Callendar's Cables, Ltd., London, England. A new company, Phillips Electrical Co. (1953), Ltd., has been formed to operate the present Brockville and Montreal plants.

The telephone manufacturing operation of Phillips Electrical Works will temporarily continue in these plants. But these operations, on an expanded basis, will be transferred as soon as practical to a plant to be constructed in Brockville by Automatic Electric Co., Chicago, Ill.

Modern Tires

(*Continued from page 362*)

displayed a tubeless truck tire which is not yet commercially available because it requires a full drop center rim, such as is used on passenger-tire wheels. The speaker supplemented his talk with showings of a stroboscopic film illustrating tire distortion at speeds more than 100 miles an hour, and a film on last year's Indianapolis Memorial Speedway race, entitled "The Fabulous 500."

New officers of the Group were elected in the business session preceding the talk. The new officers, who will be installed at the annual banquet in October, are: president, George M. Riveire, Goodyear Tire & Rubber Co.; vice president, Paul S. Greer, Office of Synthetic Rubber, RFC; treasurer, Miss Ethel Levene, Navy Bureau of Ships; secretary, Alfred M. Anisman, Office of Synthetic Rubber; and recording secretary, Mrs. Rachel J. Fanning, National Bureau of Standards.

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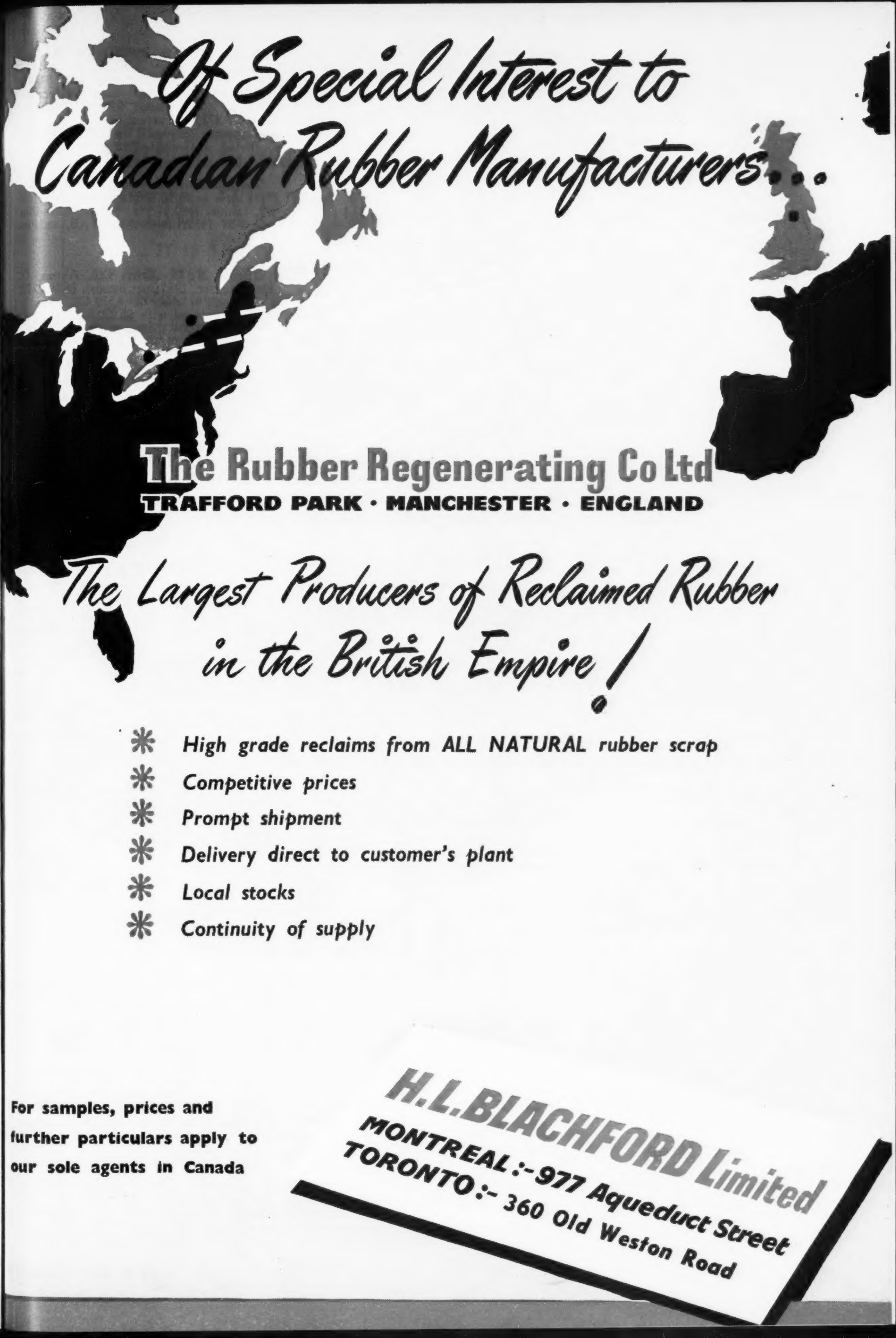


Of Special Interest to Canadian Rubber Manufacturers...
The Rubber Regenerating Co Ltd
TRAFFORD PARK · MANCHESTER · ENGLAND
The Largest Producers of Reclaimed Rubber in the British Empire!
High grade reclaims from ALL NATURAL rubber scrap
Competitive prices
Prompt shipment
Delivery direct to customer's plant
Local stocks
Continuity of supply
For samples, prices and further particulars apply to our sole agents in Canada
H.L.BLACHFORD Limited
MONTREAL :- 977 Aqueduct Street
TORONTO :- 360 Old Weston Road

OBITUARY

Hugh M. Smallwood

FUNERAL services for Hugh M. Smallwood, scientist at United States Rubber Co.'s general laboratories in Passaic, N. J., were held April 29 at the Church of St. Mary the Virgin, New York, N. Y.

Dr. Smallwood, who died April 27 after a short illness, had been a physical chemist with the rubber company since 1934. A department head at the Passaic laboratories since 1945, he had been in charge of analytical research since June, 1952, and had specialized in statistical research methods and quality control.

A graduate of Johns Hopkins, he earned his Ph.D. while studying under Dr. Harold Urey, of atomic energy fame. After graduation the deceased taught at Johns Hopkins and then at Harvard before joining U. S. Rubber.

He was a member of several technical societies including the American Statistical Association, Operations Research Society of America, National Research Council, American Society for Quality Control, the American Chemical Society, and the American Association for Advancement of Science. He is survived by his wife, three daughters, and a son.

Edmund N. David

EDMUND N. DAVID, 63, chief sales correspondent for the Akron sales district of The B. F. Goodrich Co.'s industrial and general products sales division, died last month at his home in Akron, O., following a year's illness.

He had been with Goodrich for more than 43 years. His career began as a messenger boy for Diamond Rubber Co. When that company was consolidated with BFG, Mr. David became a salesman for the New York district, later transferring to the St. Louis district before returning to Akron in 1915. Next he served for a time as assistant manager of industrial sales in the Diamond division of the company.

William A. Seiler

WILLIAM A. SEILER, 61, purchasing agent, raw materials and containers, Calco Chemical Division, American Cyanamid Co., Bound Brook, N. J., died April 22 after a brief illness.

Mr. Seiler, a native of Germany, attended Eberhard-Lindwigs Gymnasium, Stuttgart, and the University of Tuebingen.

He joined the Passaic Color Corp. as office manager in 1924 and after its acquisition by Calco in 1929 was in charge of purchasing of raw materials and containers for the Calco Division.

Mr. Seiler leaves his wife, a son, and a daughter.

Harry A. Mason

HARRY A. MASON, since 1946 assistant manager of the Cleveland office of American Viscose Corp., died suddenly at his home in Lakewood, O., May 10, the day after his forty-ninth birthday. He was born in Brooklyn, N. Y.

Mr. Mason joined the New York office of American Viscose as a clerk in 1924, working later in the viscose sales division until 1942, when he went to the vinyon and tire yarn departments.

He belonged to the Masons and Akron City, Portage Country, and Lakewood Country Clubs.

He leaves a wife and two daughters.

Richard A. Crawford

RICHARD A. CRAWFORD, 52, director of rubber research for The B. F. Goodrich Co., died unexpectedly at his home in Akron, O., recently. He had worked at the rubber company 29 years and had won national recognition as a specialist on reclaimed rubber, rubber cements and adhesives, and the compounding of latex.

Born in Logan, O., he attended schools in Dayton and Seattle, Wash., and received his bachelor's and doctor's degrees from Ohio State University. Crawford was a member of the American Chemical Society and the American Institute of Chemical Engineering as well as Phi Beta Kappa, Sigma Xi, and Phi Lamba Epsilon.

FINANCIAL

American Zinc, Lead & Smelting Co., Columbus, O., and wholly owned subsidiaries. First three months, 1953: net income, $448,519, equal to 54¢ a common share, contrasted with $951,396, or $1.29 a share, in the 1952 quarter.

Belden Mfg. Co., Chicago, Ill. First three months, net profit, $313,922, equal to 98¢ a share, compared with $218,486, or 68¢ a share, in the 1952 period.

Borg-Warner Corp., Chicago, Ill., and subsidiaries. Quarter ended March 31, 1953: net earnings, $6,340,112, equal to $2.59 a common share, against $5,313,615, or $2.21 a share, in the 1952 months; net sales, $113,944,423, against $89,655,238.

Cooper Tire & Rubber Co., Findlay, O., and wholly owned subsidiaries. Initial quarter, 1953: net earnings, $228,832, equal to $1.46 a common share, contrasted with $26,046, or 17¢ a share, a year earlier; net sales, $6,159,806, against $3,338,997.

DeVilbiss Co., Toledo, O., and wholly owned subsidiary. January 1-March 31, 1953: net earnings, $246,297, equal to 82¢ a common share, against $222,675, or 74¢ a share, a year earlier.

Byron Jackson Co., Los Angeles, Calif. March quarter, 1953: net income, $277,689, equal to 52¢ a common share, against $366,910, or 69¢ a share, in last year's quarter.

I. B. Kleinert Rubber Co., New York, N. Y. For 1952: net income, $308,901, equal to $2 a common share, compared with $282,975, or $1.82 a share in 1951.

Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont., Canada. For 1952: net profit, $315,083, compared with $446,871 the year before; provision for income taxes, $279,000, against $395,000; current assets, $8,873,562, current liabilities, $1,737,572, against $9,494,621 and $3,067,762, respectively, on December 31, 1951.

Goodall-Sanford, Inc., Reading, Mass. First three months, 1953: net profit, $716,849, against $991,413 in the corresponding period of 1952: sales, $20,392,008, against $18,877,893.

The B. F. Goodrich Co., Akron, O. First quarter, 1953: net income, $8,105,712, equal to $1.94 each on 4,170,425 common shares, compared with $6,929,549, or $1.61 each on 4,138,004 shares, in the 1952 quarter; net sales, $171,175,551, against $18,248,530.

Goodyear Tire & Rubber Co., Akron, O., and subsidiaries. First three months, 1953: net income, $11,284,000, equal to $2.42 a common share, compared with $7,372,273, or $1.52 a share, in the similar quarter of 1952; net sales, $303,552,000, against $280,844,765.

Hewitt-Robins, Inc., Stamford, Conn. First three months, 1953: net earnings, $244,313, equal to 85¢ a share, against $235,327, or 82¢ a share, in the 1952 period; net sales, $9,325,789, against $9,249,580.

Intercontinental Rubber Co., Inc., New York, N. Y., and subsidiaries. Year ended December 31, 1952: net profit, $11,618, equal to 2¢ a common share, compared with $473,625, or 79¢ a share, in 1951; net sales, $139,455, against $892,180; provision for U. S. and Mexican income taxes, $20,000, against $207,671; current assets, $1,490,400, current liabilities, $29,459, against $1,700,713, and $240,120, respectively, on December 31, 1951.

Mansfield Tire & Rubber Co., Mansfield, O. Year to December 31, 1952: net earnings, $1,334,000, equal to $2.41 a share, compared with $2,107,414, or $3.81 a share in the preceding year.

Minnesota Mining & Mfg. Co., St. Paul, Minn. First quarter, 1953: net income, $4,256,859, equal to 53¢ a common share, against $3,740,188, or 47¢ a share, a year earlier; sales, $51,062,122, against $43,973,453.

Mount Vernon-Woodberry Mills, Inc., New York, N. Y. First quarter, 1953: net earnings, $623,000, equal to 97¢ a common share, compared with $990,000, or $1.54 a share, in the 1952 quarter.

National Lead Co., New York, N. Y. Initial quarter, 1953: net income, $6,202,049, equal to 54¢ a share, against $4,689,134, or 41¢ a share, in the 1952 period.

National Motor Bearing Co., Inc., Redwood City, Calif., and wholly owned subsidiaries. For 1952: net profit, $858,912, equal to $2.02 a share, compared with $1,116,545, or $2.62 a share, the year before; sales, $17,066,689, against $18,872,550; income taxes, $1,302,373, against $2,416,489.

Okonite Co., Passaic, N. J. For 1952: net earnings, $2,123,977, equal to $13.36 a common share, contrasted with $1,509,886, or $10.12 a share, the year before.
First quarter, 1953: net profit, $714,216, equal to $4.49 a share, against $530,971, or $3.56 a share, in the corresponding period.

O'Sullivan Rubber Co., Winchester, Va. For 1952: net profit, $175,385, equal to 36¢ a common share, against $220,885, or 48¢ a share, in 1951.

Parke, Davis & Co., Detroit, Mich. For 1952: net income, $16,256,343, equal to $3.32 a common share, against $19,053,742, or $3.89 a share, in the previous year.

Phelps Dodge Corp., New York, N. Y., and subsidiaries. For 1952: net income, $35,026,550, equal to $3.45 a common share, contrasted with $42,977,434, or $4.24 a share, the year before; sales, $262,915,557 (a record), against $258,162,394.

Phillips Petroleum Co., Bartlesville, Okla., and subsidiaries. For 1952: net income, $75,284,261, equal to $5.17 a share, against $73,711,229, or $5.11 a share, in 1951; federal income tax provision, $16,500,000, against $22,210,376; current assets, $222,786,999, against $193,457,557; current liabilities, $117,565,232, against $107,339,968.
First quarter, 1953: net profit, $17,755,565, equal to $1.22 each on 14,583,022 shares, against $19,772,140, or $1.37 each on 14,438,225 shares, in the like period last year.

Pittsburgh Coke & Chemical Co., Pittsburgh, Pa., and subsidiaries. Year ended December 31, 1952: net income, $2,163,000, equal to $2.12 each on 815,097 common shares, contrasted with $3,093,000, or $3.65 each on 729,266 shares, in 1951; sales, $38,700,000, against $48,663,000.
Initial quarter, 1953: net income, $783,000, equal to 75¢ a share, against $736,000, or 71¢ a share, in the same months of 1952.

Seiberling Rubber Co. of Canada, Ltd., Toronto, Ont. Year ended December 31, 1952: net profit, $220,822, equal to $4.42 a share, compared with $135,536, or $2.71 a share the year before.

U. S. Rubber Reclaiming Co., Inc., Buffalo, N. Y. For 1952: net earnings, $190,544, equal to $1.54 a common share, contrasted with $301,719, or $2.46 a share, a year earlier; net sales, $5,448,922, against $7,645,730.

Pittsburgh Plate Glass Co., Pittsburgh, Pa. For 1952: net profit, $36,771,925, equal to $4.07 a share, against $31,075,981, or $3.44 a share, in 1951; net sales, $40,255,085, against $404,202,528; tax provisions, $46,070,828, against $72,913,833.
Initial quarter, 1953: net income, $9,571,034, equal to $1.06 a share, against $8,731,726, or 97¢ a share, in last year's period; net sales, $113,163,735, against $97,439,160.

St. Joseph Lead Co., New York, N. Y. For 1952: net income, $9,638,455, equal to $3.55 a common share, against $13,577,236, or $5 a share, in 1951.

Seiberling Rubber Co., Akron, O., and subsidiaries. For 1952: net earnings, $948,915, equal to $2.43 each on 301,010 common shares, contrasted with $1,216,574, or $3.30 a share, in 1951; net sales, $41,646,702, against $43,681,425; income and excess profits taxes, $1,325,000, against $2,395,215; current assets, $14,945,441, current liabilities, $4,902,482, against $15,283,882 and $5,625,479, respectively, on December 31, 1951.
March quarter, 1953: net earnings, $179,280, equal to 33¢ a share, against $163,332, or 36¢ a share, in the 1952 quarter; net sales, $9,407,127, against $8,932,086.

Shell Oil Co., New York, N. Y. Twelve months to December 31, 1952: net income, $90,872,834, equal to $6.75 a share, against $97,020,194, or $7.20 a share, the year before.

Textileather Corp., Toledo, O. For 1952: net earnings, $254,305, equal to 43¢ a common share, against $278,861, or 47¢ a share, in the preceding year; net sales, $16,617,964, against $16,372,761.

Thermoid Co., Trenton, N. J. For 1952: net profit, $1,084,832, equal to $1.20 a common share, contrasted with $1,742,460, or $2.02 a share, in 1951; sales, $36,749,443, against $37,836,200.

Timken Roller Bearing Co., Canton, O. For 1952: net income, $10,596,534, equal to $4.38 a share, contrasted with $14,068,109, or $5.81 a share, in 1951.

Westinghouse Air Brake Co., Wilmerding, Pa. For 1952: net earnings, $10,515,186, equal to $2.55 a share, against $11,572,652, or $2.81 a share, in 1951; sales, $93,619,110, against $93,909,846.
First quarter, 1953: net profit, $2,188,218, equal to 53¢ a common share, against $2,697,680, or 65¢ a share, in last year's period; sales, $27,926,085, a new high.

Union Asbestos & Rubber Co., Chicago, Ill. Year to December 31, 1952: net profit, $617,236, equal to $1.30 a common share, compared with $773,807, or $1.63 a share, the year before.

United Carbon Co., Charleston, W. Va. First three months, 1953: net earnings, $1,005,909, equal to $1.26 a share, against $896,097, or $1.13 a share, a year earlier.

United Engineering & Foundry Co., Pittsburgh, Pa., and subsidiaries. For 1952: net income, $3,772,906, equal to $1.51 a common share, against $3,845,710, or $1.54 a share, in 1951; net sales, $85,097,554 (a new high), against $67,388,758; provision for income and excess profits taxes, $5,107,000, against $5,016,000; current assets, $31,212,040, current liabilities, $17,924,346, against $25,948,656 and $13,589,288, respectively, on December 31 1951.

United States Rubber Co., New York, N. Y., and subsidiaries. For 1952: net profit, $28,169,955, equal to $4.33 a common share, compared with $30,366,449, or $4.76 a share, the year before; net sales, $850,151,566 (a new high), against $837,222,092; taxes, $60,384,335, against $71,111,862; current assets, $361,757,637, current liabilities, $155,521,338, against $354,727,449 and $177,697,159, respectively, on December 31, 1951.
First half, 1953: net profit, $7,156,608, equal to $1.10 a common share, against $6,247,733, or 94¢ a share, a year earlier; net sales, $226,933,883, against $220,518,963.

Viceroy Mfg. Co., Ltd., Toronto, Ont., Canada. Year ended February 28, 1953: net profit, $268,384, equal to $1.14 a share, against $255,008, or $1.08 a share, in the preceding fiscal year.

Dividends Declared

Company	Stock	Rate	Payable	Stock of Record
Armstrong Rubber Co.	A & B	$0.50 q.	July 1	June 12
	Pfd.	0.59$\frac{3}{8}$ q.	July 1	June 12
Canadian General Electric Co., Ltd.	Com.	2.00 q.	July 1	June 12
Firestone Tire & Rubber Co.	Pfd.	1.12$\frac{1}{2}$ q.	June 1	May 15
General Tire & Rubber Co.	Com. ($2.50)	0.50 q.	May 29	May 19
Goodall-Sanford, Inc.	4% Pfd.	1.00 q.	June 1	May 15
	6% Pfd.	0.25 q.	June 1	May 15
I. B. Kleinert Rubber Co.	Com.	0.25	June 12	May 29
Lea Fabrics, Inc.	Com.	0.50 extra	May 28	May 8
		0.37$\frac{1}{2}$ q.	May 28	May 8
Okonite Co.	Com.	0.50 q.	May 1	Apr. 15
Westinghouse Air Brake Co.	Com.	0.40 q.	June 15	May 29
S. S. White Dental Mfg. Co.	Com.	0.37$\frac{1}{2}$ q.	May 16	May 4

Foreign Trade Opportunities

The firms and industries listed below recently expressed their interests in buying in the United States or in United States representations. Additional information concerning each import or export opportunity, including a World Trade Directory Report, is available to qualified United States firms and may be obtained upon inquiry from the Commercial Intelligence Unit of the United States Department of Commerce, Washington, D. C., or through its field offices, for $1 each. Interested United States companies should correspond directly with the concerns listed concerning any projected business arrangements.

Export Opportunities

Shirokiya Department Store, OSS Department, No. 9, Tori 1-chome, Nihonbashi, Chuoku, Tokyo, Japan: sporting goods, stationery products.

Robert Tissot & Fils, 5-7 Escaliers du Grand-Pont, Lausanne, Switzerland: rubber goods used in the automotive and shoe industries.

Claussen & Wieting, 82 Parkstræsse, Bremen, Germany: synthetic rubber.

F. Genoud S. A., 2 rue Etraz, Lausanne, Vaud, Switzerland: tiles (asphalt, rubber, and/or plastic) suitable for industrial and household use.

Aktiebolaget Visent, 2 S:t Johannesgatan, Malmo 4, Sweden: chemicals and equipment used in the rubber industry.

Import Opportunities

Spiesshofer & Braun, Heubach, Wuerttemberg, Germany: girdles, garters, garter belts, elastic panties, etc.

Gebr. Battenfeld, Maschinenfabrik, 12 Teichstrasse, Meinerzhagen, Germany: injection molding machines for thermoplastic products.

Larvik Pigmentfabrikk A/L, P. O. Box 81, Larvik, Norway: zinc oxide for the rubber industry.

Ferguson & Co. (Ceylon), 28 Prince St., Colombo 11, Ceylon: rubber.

(Continued on page 414)

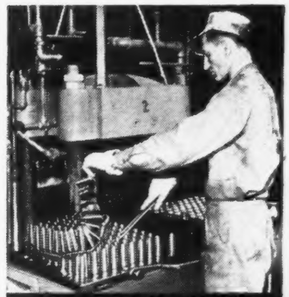
. . . and cut mold maintenance costs by as much as 80%

Inspector Mike used to fill the scrap bins when white or light-colored parts were running. But Moe Muscles has put an end to all that with Dow Corning silicone release agents. Brilliantly clean and free from surface blemishes, even white parts leave the mold unstained by carbonized lubricants or mold dirt.

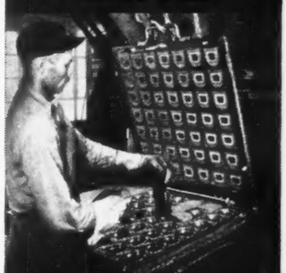
That's because Dow Corning silicone mold lubricants can't break down to form a carbonaceous deposit on mold surfaces. Molds stay clean 5 to 20 times longer than they do with ordinary release agents. Sharp detail, closer tolerances and high surface finish are assured — even on heavily loaded stocks. And mold maintenance costs are reduced by as much as 80%.

For easier release, lower production costs, improved quality and better appearance, specify Dow Corning silicone release agents: fluid for green carcass, bead and parting line release; emulsions for molds, mandrels and curing bags.

For lower costs specify DOW CORNING SILICONE RELEASE AGENTS


Deep Cavity Molds


Curing Bags


Heavily Loaded Stocks

For more information, call our nearest branch office or write direct for data sheet M-6.

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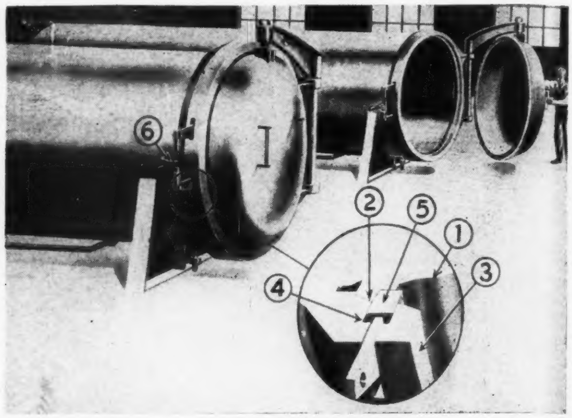
In Canada: Fiberglas Canada Ltd., Toronto In Great Britain: Midland Silicones Ltd., London

New Machinery



Cutaway Section of Quick-Opening Door Showing: (1) Door; (2) Door Frame-Door Intersection; (3) Flange; (4) Annular Groove; (5) Split Ring; and (6) Hand-Operated Jack

Quick-Opening Door for Pressure Vessels

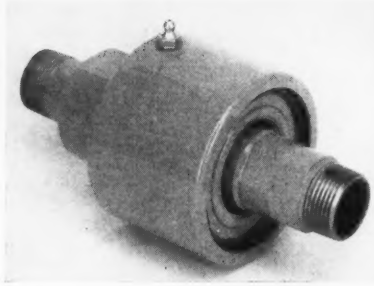
BLAW-KNOX CO., Pittsburgh, Pa., has developed a quick-opening door for use on pressure vessels. This door operates on an expanding split ring which floats in an annular space formed by the door frame, door, and flange. Expansion or contraction of the split ring by a hand-operated jack or hydraulic cylinder opens or closes the door as required.

The new door is claimed to have been proven in use. One rubber manufacturer using it on a vulcanizer has reportedly cut the time required for door operation from 20 minutes to 30 seconds. The quick-opening doors have been built to withstand temperatures of 400° F. and pressures up to 300 psi. Adaptations for use on equipment operating at or below atmospheric pressure also have been made.

Pressure Control Package Unit

Pressure Control-Valve Combination

THE new Merit Type E296 pressure control package unit, manufactured by Emmett Machine & Mfg. Co., Akron, O., provides a preassembled combination of a proper sized diaphragm valve in a free flow pattern together with a simple pressure control unit. The fine sensitivity of the controller, which can be dismantled, cleaned, and reassembled in less than two minutes, together with the low pressure drop through the valve, is claimed to provide a very fine maximum flow condition when required. Available with a 300-pound valve in standard or V-port assembly and offering a choice of pressure elements from 10 to 500 pounds, the unit is adaptable to a wide variety of applications. Normal operations require 30 pounds of air pressure for the diaphragm, although some gases can be used directly through the control without the necessity of external air supply.



ANCO Rotary Joint for Steam

ANCO Side Port Hydraulic Relief Valve

Rotary Pressure Joint and Valves

A NEW rotary pressure joint, a check valve, and a pressure relief valve are being marketed by ANCO, Inc., Providence, R. I. The joint, which can reportedly tolerate misalignment or eccentricity of the sealing members up to 10 degrees, is said to be capable of conveying steam under pressures up to 350 psi. and liquids under 3,500 pounds' pressure. Single or double race ball bearings, self-adjusting wear take-up, a self-lubricating seal, and an auxiliary seal are features of the new joint. Self-supporting, it contains only 14 parts and can be used with or without a siphon. The joint is available in all pipe sizes from 1/4-inch to five inches, inclusive, and can be supplied to withstand chemical reactions with materials to be handled.

The check valve, containing seven parts, only one of which moves, is said to be designed for long life. The seat is formed of two hardened steel pieces ground and lapped together. Available in all standard and aircraft pipe sizes, the valve claims the following: no return flow; minimum of pressure drop across it; no leakage; and at all pressures, a cracking pressure of five pounds or less.

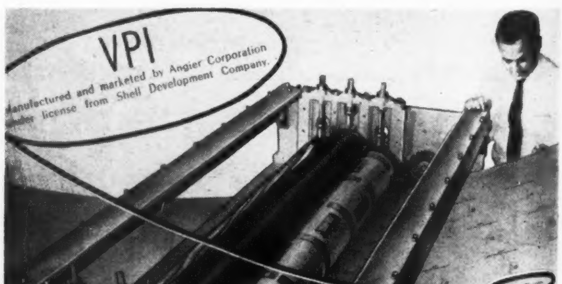
The pressure relief valve also contains only one moving part and is designed for long service in relieving and equalizing excessive pressures. Both low and high pressures can be used, and a relief flow through the valve is permitted to prevent excessive pressures despite changes in demand. The valve is available in all standard and aircraft pipe sizes. It fits into the line like a coupling and is said to be considerably lighter than other valves of equal capacity.

Printing-Processing Machine

THE Gottschoprinter, a machine for printing most types of materials processed as continuous webs, has been developed by Adolph Gottscho, Inc., Hillside, N. J. The machine can be installed with little or no change in the existing processing set-up and prints the trade marks or other identifying names on the material prior to winding, sheeting, slitting, or other fabricating operations.

Rubber plates are mounted on a steel cylinder by means of an adhesive, and impressions are made as the web of material

(Continued on page 392)



Gottschoprinter Continuous Web Printer

New Materials

Accelerator Masterbatch

KURE-BLEND MT, a latex compounded ultra-accelerator masterbatch containing 50 parts of tetramethyl thiuram disulfide coprecipitated with 50 parts of GR-S type of rubber, has been announced as available by Harwick Standard Chemical Co., 60 S. Seiberling St., Akron 5, O. The material is a new product of the chemical division of The General Tire & Rubber Co., Akron.

The material may be used in either a Banbury or an open-type mill and reportedly disperses readily in all types of natural rubber, GR-S, or nitrile rubber. Its use is claimed to eliminate dusting and permit more accurate weighing.

The same amount of activation is obtained with Kure-Blend MT as with tetramethyl thiuram disulfide in powder or rod form. When Kure-Blend MT is used in nitrile rubber stocks, the small quantity of GR-S in the masterbatch is said to have no effect on the properties of the stock. The company also reports that samples of Kure-Blend MT aged for more than one year at room temperature in its laboratories showed no signs of deterioration of the dispersing or accelerating qualities.

Sodium Epoxystearate

W. C. HARDESTY CO., INC., has announced the addition of the sodium salt of 9,10-epoxystearic acid to its line of products. The powdered compound is off-white in color and is claimed to be 90% pure. Other data include: melting point, 210-215° F. (decomposes); iodine number, 1.0; solubility in water, approximately 10%; and water content, about 0.2%.

The sodium epoxystearate is said to be approximately five times more stable than the acid and can be used in making derivatives of 9,10-dihydroxy stearic acid for use as stabilizing agents in polyvinyl chloride and other halogenated products, and for use in modifying alkyd resins. The chemical is presently available in experimental quantities.

Silicone Coating Material

GENERAL ELECTRIC CO., Pittsfield, Mass., has developed a new silicone rubber coating material to replace silicone resins in insulation applications. Designated SE-100, the white, putty-like compound is reported to have weather and corona resistance, water repellency, and release characteristics common to most silicone rubbers in addition to the following properties: higher dielectric strength than any other known silicone rubber coating material; faster curing than silicone resins; excellent abrasion resistance; tensile strength of 150 pounds per inch of

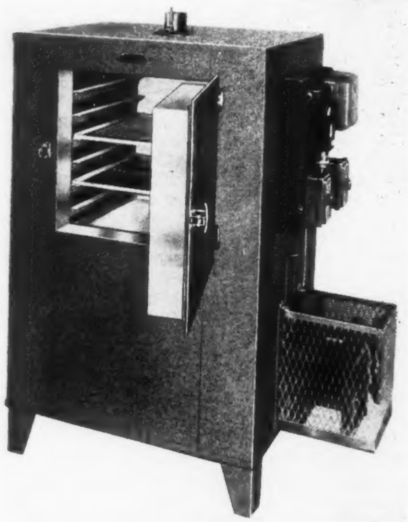
width; and high flexibility which permits easy bending over a ⅛-inch mandrel at —60° C. Its performance under temperature variations from ambient to 315° C. shows unusual stability, no softening or flowing, and little change in electrical properties.

Possible electrical applications of the new material, which is available as 100% solids or as a 35% solids dispersion in xylene (SE-100S), include: a coating for glass cloth or mat, organic fibers, mica mats, etc.; and encapsulating material for coils and cores; an impregnant for glass-served wire; and a capacitor dielectric. Gaskets, flexible ducts and tubes, adhesives, and stripping coats are possible non-electrical uses of the material.

Printing-Processing Machine

(Continued from page 390)

passes between the plate cylinder and the impression roll. Metal, rubber, plastics, and other similar materials varying in thickness from 0.001- to one inch can be printed with this machine, which is available in different models to accommodate maximum material widths of 24, 36, 48, and 72 inches.



Grieve-Hendry Cabinet Oven

New Line of Drying Ovens

A NEW line of cabinet ovens for closely controlled production and laboratory use has been introduced by the Grieve-Hendry Co., Inc., Chicago, Ill. The ovens are equipped with a high-pressure motor-driven blower which propels heated air in a definite air-flow pattern through the work chamber. This is claimed to prevent any disturbance due to radiant heat and to assure temperature uniformity.

The shell is constructed of reinforced and welded 18- and 20-gage oven steel and is insulated with glass fiber. It is finished on the exterior in grey wrinkle and on the interior with 1000° silicone aluminum paint. Horizontal or vertical flow models in temperature ranges of 650-850° F. for 220- or 440-volt operation are available.

Other features of the ovens, which are claimed to give better performance and greater economy of operation, include: indicating temperature control; high-volume adjustable air-flow; high and low heat switch for close control and quick recovery; Inconel-sheathed heating elements; manual interlock for purge period operation of blower without heat; electrical interlock for turn-off of heat in case of blower motor failure; and adjustable, positive exhaust and intake.

"TennyZphere Altitude Chambers." Tenny Engineering, Inc., Newark, N. J. 4 pages. Performance data, standard and special features, specifications, and chamber construction information on the company's standard line of altitude chambers are given in this illustrated pamphlet.

New Goods

Traffic Lane Markers

Saf-T-Line Markers Outline Traffic Lanes in an Industrial Plant

TRAFFIC lane markers in the form of tapered plastic disks are being manufactured by Campro Sales Co., Canton, O. Called Saf-T-Line Markers, the disks are injection molded of Tenite II (cellulose acetate butyrate) and are available in white or bright yellow color for visibility. Three inches in diameter, the disks are feather edged, tapering up to a ¼-inch high center, thereby warning pedestrians or vehicle operators by sight and feel. The plastic is tough, durable, and resistant to oil, grease, hydrocarbons, and ordinary cleaning solvents, it is said.

Spaced approximately 24 inches apart, the disks are easily applied to any asphalt, wood, or concrete floor or road by means of Mastic and a center nail. Features include low initial cost, expected service life of 2-5 years, elimination of traffic lane painting and maintenance, and quick installation without the need of waiting for paint to dry. Besides outdoor applications under all weather and traffic conditions, the markers are highly suitable for outlining traffic lanes and work areas in industrial plants.

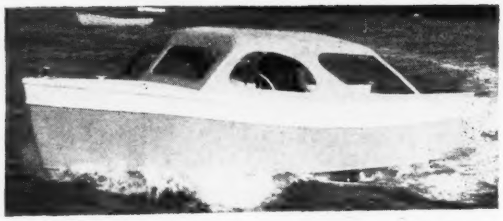
Rubber Floor Wire Duct

Flexiduct Rubber Duct and Fittings for Floor Wire Protection

FLEXIDUCT, a new rubber floor duct, has been developed by Winders & Geist, Inc., Lincoln, Neb., to eliminate over-the-floor wiring problems in office buildings, warehouses, etc. Providing complete protection for all types of inside wiring installations, Flexiduct is moisture proof and will wear almost indefinitely, it is claimed. The duct, made of rubber, is 2¾ inches wide at the base and rises from a feather edge to an apex 7/16-inch high. The duct is quickly and easily applied in any desired length with a special cement, thereby eliminating expensive floor drilling. Its flexibility allows the duct to adhere evenly and securely to all types of floor surfaces; yet it can be removed at will by prying one end loose and pulling it up.

Riser fittings are available so that wires may be run directly up under desks or other equipment. Installation is simplified by means of L-type and T-angle fittings. Typewriters and other equipment on casters can be rolled over the duct without damage, it is also said. The standard-size duct will accommodate from two to eight conductors of inside wire. Removing the bottom web of the standard duct enables it to cover and protect four pairs of plastic covered wire. A larger-size duct is also available to carry inside wire cable as well as up to 25 pairs of switchboard cable.

Flexiduct is being produced by Goodyear Tire & Rubber Co., Akron, O., at its St. Marys, O., plant.



Seventeen-Foot Sea Rambler Made of Vibrin and Glass Fiber

Plastic Boat

A 17-FOOT reinforced plastic small craft, the Sea Rambler, has been developed and tested by the marine craft division of Bedell Engineering Co., Port Washington, N. Y. Fabricated of glass fiber and Vibrin polyester resin, product of Naugatuck Chemical Division, United States Rubber Co., Naugatuck, Conn., the boat is available in kit or finished form.

In the kit form the molded parts are bolted together and then fused into a single unit with Vibrin and glass fiber. Heat or pressure is not required since the Vibrin, when coated with glass fiber, reacts at near room temperature to make a solid seal. Thus calking is made unnecessary, and since the various parts are impregnated with color, the necessity of painting is also eliminated.

The boat is suitable for use in salt or fresh water and can be equipped with an outboard or inboard engine of 5-25 horsepower. The Bedell firm also manufactures a 16-foot reinforced plastic runabout craft in both kit and finished form.

Low-Priced Tubeless Auto Tires

THE B. F. Goodrich Co., Akron, O., is offering for public consumption a new low-priced tubeless automobile tire called the Safetyliner. This tire features a patented inner lining of rubber, impervious to air, and patented rim-sealing ridges which lock the tires to rims. It claims the following advantages over the conventional tube tires: lighter weight, hence improved vehicle steering and handling; greater mileage; and elimination of heat build-up caused by heavy tubes. The new tire supplements the company's line of puncture-sealing tubeless tires for autos and tubeless tires for aircraft and farm implements.

Asbestoprene Gasket Material

A NEW gasket material, Asbestoprene, has been developed from asbestos and du Pont's neoprene by the Victor Mfg. & Gasket Co., Chicago, Ill. This material is said to combine the compressibility of cork and rubber with the heat resistance of asbestos. Recommended as a replacement for glue-glycerin treated paper, since it is more compressible and heat resistant, Asbestoprene is further claimed to have much better dimensional stability than the treated paper as well as being non-corrosive to light metals and resistant to oils, water, gasoline, and antifreeze solutions.

Automotive applications seem to be a probable prospect for the new material which has been used successfully as cover gaskets on tractor engines. Its cost is intermediate between that of gelatin-treated plant fiber and rubber-bonded cork.

Asbestoprene is made on modified paper-making machines where the neoprene can be added in latex form to asbestos pulp. This method of combining the two materials was made possible by du Pont's recent development of a special neoprene latex suitable for paper pulp to make wet strength paper. Victor found that the new latex could be used with asbestos substituted for paper pulp. The advantage of the pulp-addition technique is the thoroughness with which the neoprene is dispersed on the asbestos fibers since its effectiveness is a direct function of the binder's dispersion.

Physical properties of the Asbestoprene are as follows: tensile strength, minimum of 1,500 psi. and 500 psi. in the machine and cross-machine directions, respectively; Mullen burst strength, 130 pounds per 1/16-inch gage; compressibility, 20-30% at loading of 1,000 psi.; recovery, 40% minimum; hardness, 70 plus or minus 10 Shore durometer A; flexibility, a 1/16-inch sheet can be bent around a 1/32-inch mandrel without cracking; oil resistance, 90% minimum retention of tensile strength, and 5% maximum thickness change, after a five-hour immersion at 300° F. in ASTM No. 1 test oil; gasoline resistance, 0 to plus 5% thickness change after five-hours' immersion at 70° F. in ASTM No. 1 reference fuel.

EUROPE

FRANCE

Neolatex—Artificial Dispersions

French manufacturers recently began to prepare artificial dispersions from raw or reclaimed rubber, among others Société Les Dispersions Artificielles, which puts out various types of dispersions under the trade name, Neolatex. The kinds presently available are Neolatex 450, 500, 257, and 503. The first two are light-colored dispersions of natural rubber; while the last two are black and are made from whole tire reclaim. Neolatex 257 and 450 are liquids; the other two are pastes. The liquids are said to be stable in alkaline media, to have colloidal properties similar to those of natural latex, and to be mixable with the latter. The pastes are stable in neutral surroundings and can be mixed only with stabilized natural latex. Both liquids and pastes are vulcanizable by the addition of a vulcanizing dispersion just like natural latex and can be used alone or mixed with the latter for a large variety of purposes—for making sponge rubber, in flow-casting, treating tire cord, proofing and impregnating fabrics, sizing felts, soundproofing metal sheets in automobile manufacture; they are also useful in paints, can be mixed with bitumen for roads, and serve as protective coatings for vats, tanks, and the like and also for waterproofing purposes in buildings.

Structure of Chlorinated Rubbers

In recent articles,[1] on the structure of chlorinated rubber, R. Allirot and L. Orsini reveal the results of their studies of infrared absorption spectra of maximally chlorinated rubber (chlorinated to the limit). In an earlier study one of the authors had shown that products obtained by prolonged chlorination of rubber dissolved in carbon tetrachloride are of homogeneous composition, corresponding to the formula $(C_{10}H_xCl_7)_n$ (where x is between 11 and 13) irrespective of their molecular weight.

In the course of the present work it was found that the spectra of solutions of three fractions of maximally chlorinated rubber are superposable, permitting the conclusion that the macromolecules of such rubbers have identical structure, whatever their molecular weight may be. Comparison of these spectra with those of natural rubber and partially chlorinated rubber led to the further conclusion that chlorinated rubber containing more than 57.2% of chlorine is a saturated product whose basic unit, $C_{10}H_xCl_7$, has a cyclohexanic structure, thus confirming Farmer's hypothesis. Such a formula is only conceivable if the value of x is taken to be 11, the authors add.

[1] *J. chim. phys.*, 49, 422 (1952); *Rev. gén. caoutchouc*, 30, 1, 42 (1953).

NETHERLANDS

The February issue of *Rubber*, organ of Rubber Stichting, Delft, features the use of rubber in floors. A new material, recently put on the market after prolonged testing both at the Rubber Stichting and by the manufacturer, is Elastoleum tile, made of rubber with China clay and wood-flour as fillers, to which undisclosed chemicals have been added. Produced by N. V. Rubberfabriek Wittenburg, Elastoleum is said to be cheaper than rubber floors, very durable, sound-absorbing, resilient, not easily flammable, and comes in a large variety of colors. The surface is claimed to have better grip, that is non-slipping qualities, than linoleum or the usual rubber floors, and so is safer. At the same time, heavy furniture leaves no permanent dents; one could—if so minded—move a grand piano from one part of a room to the other every six weeks without leaving a "mosaic of dents and pits in the floor surface," says the article in question. Finally Elastoleum tiles can be taken up from a floor and relaid elsewhere with little loss.

Another type of tile, made by the Arufa concern of Arnhem, from a rubber hydrochloride powder produced directly from latex, after a Rubber Stichting process, consists of two layers—an upper, thin hard layer of the rubber hydrochloride on a base of a slightly softer and somewhat more elastic vulcanized

rubber. The surface of the Arusto tiles, as they are called, is non-skid even when wet, it is claimed, and is little, if at all, affected by acids, bases, oils, fats, and solvents; furthermore, this flooring has abrasive resistance four times that of ordinary rubber. The softer lower layer deadens the sound of footsteps and absorbs slight unevennesses in the floor underneath. The tiles are made with a highly polished or mat finish.

A third type of flooring, Plasoleum, consists basically of Revertex, cement, and various fillers as ground cork, rubber waste, grains of marble or granite, and pigments prepared by a British process. Manufacturing rights which have been acquired by a Dutch firm for the Benelux countries. The cement and fillers are turned into the Revertex, thoroughly mixed and spread immediately, when a resilient, waterproof floor with good non-slip qualities and good abrasion resistance is obtained. Plain black factory floors that are unusually strong can thus be prepared, and also a variety of decorated and plain colored surfaces, it is further claimed.

In addition mention is made of a novel method of soundproofing for apartment houses and the like, in which a so-called floating floor is used, and that has been developed by the Building Research Station, in England. On a concrete subfloor is spread a layer of paper, on which iron screw-boxes are placed about two feet apart. Then lightly reinforced concrete is poured on to a thickness of about two inches, the paper prevents the new surface from adhering to the concrete floor underneath. When the new concrete surface has hardened, small wooden blocks are placed in some of the screw-boxes, and on top of these, plugs threaded to fit the threads of the screw-box. When the plugs are given a few down turns, the entire concrete floor rises, and when a free space of about an inch has thus been created, plugs, to the underside of which solid rubber blocks have been fixed, are screwed into the empty screw-boxes; the wooden blocks also are replaced by rubber and the weight of the whole surface is evenly distributed over the rubber blocks. The screw-boxes are closed, and the whole is suitably finished.

Rubber Stichting has acquired a continuous drying belt suitable for the production of sheet from compounded latex. Manufacturers are invited to use the device for testing new processes. Small tests that take only a short time may be run free of charge; for longer experiments, the actual costs of gas, electricity, and, where required, labor, will have to be paid.

SPAIN

Considering it important to Spain's economy to be independent of imports of natural rubber, Spanish authorities encouraged experiments in the local cultivation of suitable rubber-bearing plants. Because it yields a fair harvest of rubber annually, and the rubber is of relatively good quality, containing practically no resin, it was decided to test *kok-saghyz*. In 1950, seeds supplied by the United States Department of Agriculture, Washington, D. C., were planted in various parts of the province of Leon so that the effect of different soil and climatic conditions on rubber formation would be studied. In a paper: "Experiments in Cultivation of *Taraxacum Kok-Saghyz*, Rodin," published by the National Institute of Agricultural Research, in its Bulletin No. 26, and also separately as No. 176, June, 1952, T. Horche and W. de Rafols describe methods and results. Although not carried out under optimum conditions, these first tests nevertheless are said to have demonstrated that the climatic conditions of the areas selected are well suited to the plant; the roots obtained are claimed to have had a high rubber content, up to 10%, dry weight.

While the cultivation of *kok-saghyz* is thus feasible, exploitation of the plant for its rubber alone does not appear to be remunerative, and investigations have been undertaken aiming at the development of a profitable by-product from the plant. Since *kok-saghyz* is found to have a high content of carbohydrates—chiefly polymers of levulose—belonging to a group related to inulin, the possibility of producing ethanol by fermentation of the roots has been considered.

Working under a scholarship from the International Fellowship Program, of Joseph E. Seagram & Sons, Inc., Louisville, Ky., de Rafols carried out investigations set forth in a paper: "Fermentation of the Roots of *Taraxacum Kok-Saghyz*, Rodin." which by permission of the Seagram concern, appeared in the Bulletin already mentioned, and also separately, as No. 167, June, 1952. The literature related to the subject, particularly that referring to the carbohydrates of the plant, is reviewed, and details are given of three fermentation processes investigated. The most suitable proved to be direct fermentation with *Saccharomyces fragilis*, Jor, by means of which a yield of 90% in absolute alcohol per unit of fermentable material was obtained in the laboratory.

FAR EAST

MALAYA

Business Bad

In its monthly report for March, 1953, the Labor Department of the Malayan Federation noted the general effect of the rubber slump over the whole country. Small proprietors seemed especially vulnerable, and increasing numbers were stopping production and putting their plantations on a care and maintenance basis; all kinds of trade were slackening; store profits were down, and retrenchment is becoming evident.

The further drop in the market following peace overtures in Korea, coming as it did after a period during which prices had fallen to the lowest levels in over two years, was not calculated to lift spirits in rubber circles. On April 10 the retiring president of the United Planting Association of Malaya, H. Facer, was telling members that the price had reached a level where a few cents increase or decrease made the difference between a small profit or a loss, and was stating the case for the industry's relief from the export duty on rubber, and urging the formation of a buffer stock to prevent a disastrous fall in prices due to surplus production.

A week later Charles Thornton, president of the Federated Malay States Chamber of Commerce, warned that the "grim problem of survival" faced important sections of the rubber and tin industries, and that the government's finance policy and taxation system were not calculated to attract much needed overseas capital to Malaya.

About this time the now five-month-old dispute on the award of the Whitton Wage Arbitration Board flared up again, with renewed bitterness on the part of both employers and workers' representatives, as the drop in the price of rubber to below 70 Straits cents a pound brought the sore point of the debated wage rate, when rubber price was between 60 and 70 cents a pound, into actuality; employers refuse to accept the Whitton award based on this price range, and the union insists on it. Finally, on the demand of the union, the Arbitration Board recommended a government inquiry into the rubber industry. The government was willing to set up an inquiry commission as desired, but this was opposed by producers because a public inquiry of this kind might result in unnecessary disclosure of secrets; they also objected to the inclusion of workers.

Now the government is understood to be considering a fact-finding mission instead and is said to be consulting with the Malayan Rubber Producers' Council on a plan involving the engagement of experts from England.

Latest reports indicate that the rubber producers are preparing for this fact-finding mission and are working on plans for an extensive survey of their contribution to Malaya's finances; the Malayan Rubber Producers' Council is understood to have sent out questionnaires on amount of tax paid, capital investment, and dividends paid.

"Eliminate the Smallholder"

T. S. Bavin, secretary of the Plantations Department of the International Confederation of Free Trade Unions, who arrived in Malaya in February to survey estate conditions here and also in Indonesia, is busy attempting to explain away statements on the need of eliminating the smallholder, made to a *Straits Times* reporter, and published in the April 11 issue of that paper.

Mr. Bavin is quoted as saying, "Rubber is big business. There is no room for small people. I have told General Templer what I thought. There should be no sentiment about it. The rubber industry is a specialized affair, and only big organizations can run it economically."

He expressed himself as most concerned over the organization of the industry because it affected the welfare of the workers and the future of the country. Smallholders, he said, should be compelled to give up their plantations and take up the cultivation of palm and food crops.

Further elaborating his ideas, he suggested the establishment of a permanent rubber executive committee composed of planters and workers and responsible to the Member for Agriculture. District surveys should then be started, and estates graded as good, moderate, and "under supervision"; the latter category would include all estates not up to standard. Laws should be passed for seizing holdings if no satisfactory progress were made.

"There should be no coaxing. There should be compulsion," he is quoted as declaring.

Malaya's Problems and Aid Desired

Last April spokesmen for the rubber and tin industries had two opportunities to explain the problems of their respective branches to American visitors and to give their views on what they would like America to do for Malaya.

On April 18, Federation and Singapore Chinese leaders of the rubber industry were set to meet Adlai Stevenson, who has been on a fact-finding tour of the Far East, and undertook to convince him of the justice of their view that the United States should take all exportable Malayan rubber, since it had clamped down on the sale of Malayan rubber to Communists. Mr. Stevenson was also to be asked to use his influence in getting United States synthetic plants closed and in obtaining extension of Point Four aid to Malaya, involving supplies of agricultural and industrial equipment. The Chinese leaders, in particular, seemed to feel that it was up to America to help Malaya wipe out terrorism and Communism and bring the country back to normal. They also desired American sponsored industrialization of Malaya and wished to explore the possibility of creating a South-East Asia zone composed of the "weak and under-developed territories" of Siam, French Indo-China, Malaya, Indonesia, Borneo, and the Philippines.

At a round-table conference held in Singapore later in the same month, attended by 48 American businessmen in Singapore on a trade-promotion trip sponsored by the Detroit Board of Commerce, rubber problems were again among those discussed. On this occasion representatives of the Malayan rubber industry, after putting the facts before the Americans, apparently confined themselves to insisting on free competition for rubber.

New Cable Factory

A new submarine cable factory was recently completed for Cable & Wireless at Bukit Chermin, at a cost of £232,000. The new works, which started operating last April, replaces the old factory established in Singapore in 1887. The annual output of all types of submarine cable is expected to run to 800-900 nautical miles and will serve to maintain and develop the Far East section of the concern's extensive Commonwealth system.

Publications of the Rubber Research Institute of Malaya, Kuala Lumpur, Malaya.

"Annual Reports for 1949-51 of the Pathological Division of the Rubber Research Institute of Malaya." 118 pages. The various diseases and other destructive forces affecting the rubber plant which have been investigated over the past three years are described.

"The Journal of the Rubber Research Institute of Malaya: Determination of Volatile Fatty Acids in Natural Rubber Latex." M. W. Philpott and K. C. Sekar. February, 1953. Vol. 14, Communication 281. 118 pages. A method for determining quantitatively the volatile acids in latex by a process involving steam distillation is described in this publication.

Editor's Book Table

BOOK REVIEWS

"**Soluble Silicates,** Their Properties and Uses, Volume II: Technology." James G. Vail, assisted by John H. Wills. American Chemical Society Monograph No. 116. Reinhold Publishing Corp., 330 W. 42nd St., New York 36, N. Y. Cloth, 6 by 9 inches, 690 pages. Price, $15.

Whereas the first volume of this monograph dealt with the theoretical aspects, manufacturing methods, and properties of the soluble silicates[1] (see our December, 1952, issue, page 419), this volume covers the applications of these materials in industry. As in the preceding volume, treatment of the subject is exhaustive in all respects. Mathematical and highly specialized material is held to a minimum; tabular data are presented in graphic style wherever possible, and emphasis is placed on readability and clarity. For those desiring further details, selected literature and patent references are given throughout. The text consists of five main sections or chapters dealing with interfaces modified by silicate solutions; coatings and films; bonded surfaces; sols, gels, and polymers in industry; and physiological behavior. Comprehensive coverage is given to the applications of the silicates in the rubber, latex, resin, and plastics fields. A brief discussion of the future outlook for the silicates, as well as extremely detailed author and subject indices covering both volumes, are also included.

"**Methoden der Organischen Chemie.**" Houben-Weyl. "Oxygen Compounds (Part 3)." Volume VIII. Fourth completely revised edition. 1952. Edited by Eugen Muller, with special collaboration of O. Bayer (Leverkusen), H. Meerwein (Marburg), and K. Ziegler (Mulheim). Publishers, Georg Thieme Verlag, Stuttgart, Germany. Agents for the U.S.A., Grune & Stratton, Inc., 381 Fourth Ave., New York, N. Y. Cloth, 7 by $10\frac{1}{4}$ inches, 776 pages Price about 100 marks per volume (10% discount on each volume, if ordered in advance of publication).

Since the third edition, in four volumes, of this internationally known work on methods in organic chemistry was completed about 20 years ago, a new edition was long overdue, but had to be postponed because of wartime and early postwar conditions. Now with the special collaboration of Otto Bayer, Hans Meerwein, and Karl Ziegler, a new completely revised edition, which is to be extended to 14 volumes, averaging some 700 pages each, is in preparation and is expected to be completed within four years.

A group of chemists, experts in their respective fields, have agreed to contribute chapters on their special subjects; it will thus be possible, for the first time, to present to the chemical world a wealth of material from the patent literature and factory archives, critically evaluated.

According to the prospectus, Volume I will deal with laboratory practice and methods in general; Volume II will cover general and special analytical methods; Volume III, physical methods of research in organic chemistry; the apparatus, application of methods to organic chemistry and their limits in this respect, will be briefly discussed. Volume IV takes up general chemical methods. Volumes V-XII will be devoted to special methods of preparation and conversion of classes of organic substances. Organic preparative and analytical methods in the chemistry of natural substances (including high polymers) and preparation are to be set forth in Volume XIII. The final volume is to include general indices of authors and subjects, hints on the use of the literature, questions of nomenclature, and a new system of symbolism and classification of reactions, designed to facilitate reference to the individual volumes of the work.

Chiefly because of the differences in the length of time required by individual authors to prepare their respective chapters, Volume VIII has been the first to come off the press. It includes six chapters: (1) Preparation and Conversion of Peroxides, by R. Criegee, Karlsruhe; (2) Preparation and Conversion of Monomeric Carbonic Acid Derivatives, Siegfried Petersen, in collaboration with A. Mitrowsky and A. Dorlars (this chapter, the longest in the book, covers carbonic acid esters, carbamide acids, and their anhydrides and chlorides; isocyanates, urethanes, substituted ureas, semi-carbazides and isoureas; substituted cyanamides, carbodiimides, substituted guanidines, and aminoguanidines); (3) Preparation and Conversion of Nitriles, Isonitriles, and also Fulminic Acid, by P. Kurtz; (4) Preparation, Conversion, and Decarboxylation of Carboxylic Acids, H. Henecka, with collaboration of E. Ott; (5) Carboxylic Acid Esters, H. Henecka; (6) Preparation and Conversion of Functional N-Derivatives of the Carboxyl Groups, H. Henecka and P. Kurtz.

All but Chapter 1 and part of Chapter 4 have been contributed by well-known specialists connected with Farbenfabriken Bayer, Leverkusen and Elberfeld.

Each of the six chapters has its own detailed table of contents and a bibliography. In addition are author and subject indices at the end of the book, and lists of periodicals and abbreviations, at the beginning of the book.

NEW PUBLICATIONS

"Plastolein 9057 Dioz." Technical Bulletin 47. Emery Industries, Inc., Carew Towers, Cincinnati, O. 3 pages. Specifications, typical characteristics, and performance data on the company's new monomeric plasticizer, di-iso-octyl acetate, appear in this publication. Included is new information on electrical and mechanical properties.

"Barrett Tar Bases." Barrett Division, Allied Chemical & Dye Corp., 40 Rector St., New York 6, N. Y. 96 pages. This handsome, hard cover booklet describes the uses, specifications, properties, typical reactions, hazards and methods of handling, and test methods for the company's tar bases. Of special interest are the sections on uses entitled, "Plastics Industry and Polymer Technology," and "Cellulose Technology." Generous use of charts and graphs helps present the material in a concise, easily readable form.

"Hycar Technical Newsletter." Vol. 2, No. 5. B. F. Goodrich Chemical Co., Rose Bldg., Cleveland 15, O. 5 pages. Information on colored Hycar bag labels, data on Hycar nitrile rubber in ammonia service, and data on mineral rubber in hard Hycar stocks are contained in this publication.

"Organic Chemicals." Technical Publication SC: 52-10 Shell Chemical Corp., New York, N. Y. 88 pages. This illustrated brochure describes properties, specifications and applications of the company's solvents, industrial chemicals, resins, and plastics. Technical service facilities, fertilizers, and agricultural chemicals are also discussed in some detail.

"Blaw-Knox Resin Equipment." Bulletin No. 2414. Blaw-Knox Co., Pittsburgh, Pa. 22 pages. Factors important in the design of resin plants, including materials of construction, instrumentation, agitation, and temperature control, are discussed in this illustrated booklet.

"HSC No. 35 Silicone Emulsion." Bulletin No. 11-143-3-5-53. Harwick Standard Chemical Co., 60 S. Seiberling St., Akron 5, O. 5 pages. The properties, uses, and other data on this 35% oil-in-water emulsion of Silicone Mold Release Oil, as it is applied in the rubber and plastics industries, are described in this booklet.

Publications of Sun Oil Co., 1608 Walnut St., Philadelphia 3, Pa.

"Circosol-2XH, Sundex-53." Technical Bulletin 14. 1 page. These two products for processing natural rubber and GR-S polymers are described, and their qualifications for extending high Mooney viscosity GR-S polymers are discussed.

"Sundex-53—A Plasticizer for High Mooney Viscosity Neoprene." Technical Bulletin 18. 1 page. This catalog insert discusses the use of the material as a plasticizer for Neoprene WHU and compares it with other petroleum-base plasticizers for this application.

"The Builders." E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. 32 pages. This illustrated booklet provides a tribute to modern technology and to the employes of the company's engineering department on the occasion of its fiftieth anniversary.

"Neoprene Latex in Paper Board." PR-3, 4-30-53. 8 pages. This report summarizes the effect of neoprene on a number of the properties of board.

"Chromalox Electric Radiant Heaters: The Vinyl Report." Edwin L. Wiegand Co., Pittsburgh, Pa. 14 pages. This bulletin contains information on the use of far-infrared radiant heaters for fusing and embossing cast and calendered materials.

Publications of The B. F. Goodrich Co., Akron, O.

"Ribflex Griptop Conveyor Belt." No. 2550. 2 pages. This catalog page describes a conveyor belt which reportedly moves packages up and down grades as steep as 55 degrees.

"Conveyor and Elevator Belting: Care, Maintenance, and Installation." 34 pages. Methods of selecting belts, specifications, and installation and maintenance information are discussed and illustrated in this booklet.

"Witco Catalogue." Sixth Edition. Witco Chemical Co., 260 Madison Ave., New York 16, N. Y. 105 pages. Information regarding the products, plants, and technical literature of the company appears in this booklet.

"Witcote #820 Cork Insulation." Bulletin 53-4. 6 pages. The composition, application, and uses of this cold-application fluid-type material is given in this illustrated booklet.

"A New Management Tool for the Plastics Industry: S. Q. C." Monsanto Chemical Co., Springfield, Mass. 18 pages. The use of statistical quality control in the plastics industry is described and explained by use of charts and examples in this booklet.

"Carbon Black, 1951." D. S. Colby, H. J. Barton, and B. E. Oppegard. United States Department of Interior, Bureau of Mines. For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. 5¢. 13 pages. This pamphlet, a preprint of the chapter on carbon black in the "Bureau of Mines Mineral Year-Book, 1951," contains figures on production, demand, stocks, prices, foreign trade, and world production of carbon black.

"Atlas Industrial Chemicals." Atlas Powder Co., Wilmington, Del. 8 pages. The properties and uses of seven classes of industrial chemicals manufactured by the company, polyols, surfactants, plasticizers, textile chemicals, polyester resins, fatty acids, and activated carbons, are described in this illustrated catalog.

"1952 Annual Report, Technology Center." Armour Research Foundation of Illinois Institute of Technology, Chicago 16, Ill. 62 pages. The national and international research activities of the Foundation, which included investigations on nearly 400 projects with an expenditure of more than $8,000,000 during the past year, are discussed and illustrated in this handsome brochure.

"Chemicals—The Fastest Growing Major Industry." E. W. Axe & Co., Inc., New York, N. Y. 70 pages. This booklet contains the latest of the Axe-Houghton Economic Studies which deals in a compact fashion with the principal aspects of the chemical industry, including the fields of rubber, resins, and plastics, synthetic fibers, fluorines, silicones, atomic energy, and glass plastics. Of special interest are those articles on "The Rubber Industry in Chemicals"; "Fluorocarbons, a New Frontier"; and "Silicones, Another Chemical Frontier."

"Materials Survey: Rubber." December, 1952. Compiled for the National Security Resources Board by the United States Department of Commerce, National Production Authority. For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Paper. 71 pages. Price, $1.50. This volume of the Materials Survey series covers synthetic and natural rubber, their definition and description, production processes, raw material sources and production, U. S. and foreign imports, exports, and reexports, world stocks, consumption, prices, etc.

"U. S. Electrical Wires and Cables for the Chemical and Petroleum Industries." United States Rubber Co., Rockefeller Center, New York 20, N. Y. 73 pages. **"Identification of Synthetic Fibers by Microscopical and Dye Staining Techniques."** G. L. Royer. Calco Technical Bulletin No. 831. American Cyanamid Co., Calco Chemical Division, Bound Brook, N. J. 11 pages. **"Products for the Mining Industry."** Boston Woven Hose & Rubber Co., Cambridge, Mass. 8 pages. **"How to Get More Recaps Out of Your Truck Tires."** The B. F. Goodrich Co., Akron, O. 8 pages. **"Twenty Questions and Answers on X-Ray Analysis."** North American Philips Co., Inc., 750 S. Fulton Ave., Mount Vernon, N. Y. 8 pages.

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MARKET REVIEWS

RUBBER

ERRATIC price movements and moderate trading activity marked both the rubber spot and the futures markets during the period from April 16 to May 15. A sharp price advance began on April 22 with the news of the Communist movement into Laos, Indo-China, as well as the lack of progress in the Korean peace talks. Although Laos produces only about 50,000 tons of the world output of rubber, the Communist movement was interpreted as evidence of continued unrest in Asia, and the market reacted strongly.

The price rise reached its peak on May 4, then began an equally rapid decline in the wake of better news from Indo-China. From May 12 until the end of the period under review both the spot and the futures markets were very quiet, and prices fluctuated irregularly as dealers awaited news from the Copenhagen Rubber Study Group meeting.

New York Spot Market
Week-End Closing Prices

	Mar. 28	Apr. 18	Apr. 25	May 2	May 9	May 16
R. S. S.: #1	26.25	24.50	25.13	26.25	26.00	26.00
2	25.50	23.75	24.38	25.50	25.25	25.25
3	24.25	22.50	23.13	24.25	24.00	24.00
Latex Crepe						
#1 Thick	30.75	28.25	28.25	29.00	29.00	28.75
Thin	30.50	28.00	28.00	28.75	28.75	28.50
#3 Amber						
Blankets	24.00	22.25	22.75	23.38	23.25	23.25
Thin Brown						
Crepe	23.00	21.50	21.88	22.50	22.38	21.25
Flat Bark	21.38	19.50	20.00	20.50	21.25	20.88

The spot price for #1 Ribbed Smoked Sheets started the period at a low of 24.50¢, rose to a high of 27.50¢ on May 4, fell back to 25.25¢ on May 12, and closed at 26.00¢ on May 15. The April monthly average spot prices for certain grades were as follows: #1 R.S.S., 24.89¢; #3 R.S.S., 22.89¢; #3 Amber Blankets, 22.57¢; and Flat Bark, 20.46¢.

Commodity Exchange
Week-End Closing Prices

Futures	Mar. 28	Apr. 18	Apr. 25	May 2	May 9	May 16
July	25.50	24.00	24.40	25.50	25.25	25.40
Oct.	25.20	23.80	24.15	25.30	24.95	25.20
Dec.	24.90	23.60	23.75	24.90	24.60	24.75
Mar.	24.65	23.50	23.65	24.70	24.30	24.60
May	24.40	23.40	23.55	24.55	24.15	24.50
Total weekly sales, tons	1,340	3,240	2,280	2,840	3,350	780

Prices for rubber futures followed the lead of the spot market. July futures opened the period at a low of 23.70¢, rose to a high of 26.90¢ on May 4, and closed at 25.40¢ on May 15. Sales volume in the #1 Contract during the second half of April amounted to 5,850 tons, making a total of 10,780 tons for the month. There were no sales in the #3 Contract during the second half of April, and the monthly total for this contract was 60 tons. During the first half of May, 4,270 tons were sold in the #1 Contract, and 40 tons in the #3 Contract.

Latex

SUPPLIES of *Hevea* latex for delivery through July continued to be virtually non-existent during the period from April 16 to May 15. Indications are that supplies will be tight throughout the balance of this year, but some alleviation of the current shortage is expected in July on the basis of reports from producing areas. Use of latex by the foam sponge industry has continued at a high level, even exceeding previous estimates, but sh uld decline somewhat as automobile production drops off later in the year. Supplies of cold GR-S latex are also short in view of volume demand by the foam sponge and rug backing fields.

Prices for bulk *Hevea* latex are quoted at 35¾¢ per pound, dry solids, for delivery through August, 33⅞¢ for September delivery, and 32.75¢ for long-term contract delivery. Final February and preliminary March domestic statistics on *Hevea* and synthetic rubber latices are given in the following table:

(All Figures in Long Tons, Dry Weight)

	Production	Imports	Consumption	Month-End Stocks
Natural latex				
Feb.	0	6,339	5,642	6,905
Mar.*	0	6,000	6,347	6,554
GR-S latices				
Feb.	3,877	187	3,993	5,041
Mar.*	3,993	245	4,632	4,925
Neoprene latex				
Feb.	819	0	703	1,167
Mar.*	728	0	751	1,071
Nitrile latices				
Feb.	437	0	302	971
Mar.*	407	0	356	923

*Preliminary.

SCRAP RUBBER

BUSINESS in the scrap rubber market continued on the slow side during the period from April 16 to May 15. Reclaiming mills bought only on a limited scale, and the immediate outlook for the market was not encouraging. Small lots of scrap tubes and casings moved to both Akron and eastern points, but there were no major sales. On the supply side, stocks of scrap were reported to be satisfactory for all grades.

Following are dealers' selling prices for scrap rubber, in carload lots, delivered to mills at the points indicated:

	Eastern Points	Akron, O.
	(Per Net Ton)	
Mixed auto tires	$12.00	$13.50
S. A. G. auto tires	Nom.	Nom.
Truck tires	Nom.	15.00
Peelings, No. 1	40.00	40.00/ 42.00
2	Nom.	24.00
3	20.00	20.00
	(¢ per Lb.)	
Auto tubes, mixed	2.00	2.50
Black	3.25	3.50
Red	10.00/ 10.50	10.75
Butyl	2.00/ 2.25	2.75

RECLAIMED RUBBER

NO SIGNIFICANT changes took place in the reclaimed rubber market picture during the period from April 16 to May 15. Demand continued at a fairly even pace for the staple grades, although a slight increase in reclaim requirements for battery boxes was noted.

Final February and preliminary March statistics on the domestic reclaimed rubber industry are now available. February figures, in long tons, are: production, 24,373; imports, 210; consumption, 24,098; exports, 950; and month-end stocks, 30,631. Preliminary figures, in long tons, for March follow: production, 27,882; imports, 342; consumption, 27,386; exports, 908; and month-end stocks, 29,931.

Reclaimed Rubber Prices

	Lb.
Whole tire: first line	$0.10
Fourth line	.0875
Inner tube: black	.15
Red	.2425
Butyl	.125
Pure gum, light colored	.2425
Mechanical, light colored	.135

The above list includes those items or classes only that determine the price basis of all derivative reclaim grades. Every manufacturer produces a variety of special reclaims in each general group separately featuring characteristic properties of quality, workability, and gravity at special prices.

COTTON AND FABRICS

New York Cotton Exchange
Week-End Closing Prices

Futures	Mar. 28	Apr. 18	Apr. 25	May 2	May 9	May 16
July	33.48	33.38	33.63	33.93	33.90	34.18
Oct.	33.55	33.48	33.54	33.73	33.67	33.87
Dec.	33.63	33.56	33.59	33.68	33.61	33.86
Mar.	33.75	33.68	33.71	33.74	33.69	33.90
May	33.74	33.63	33.70	33.68	33.66	33.94
July	33.47	33.31	33.48	33.30	33.33	33.60

COTTON spot and futures prices showed an irregular advance during the period from April 16 to May 15. During the early part of the period prices were generally weak in view of liquidation sales in the old May contract. A recovery took place, spurred by short coverings and price fixings, and prices were generally firm throughout the balance of the period.

The spot price for 15/16-inch middling cotton started the period at 33.85¢, dropped to a low of 33.50¢ on April 22, advanced to a high of 34.70¢ on May 4, and closed at 34.50¢ on May 15. Futures prices moved correspondingly, with most strength being displayed by July contracts as traders foresaw a tight market toward the close of the current season on July 31.

Fabrics

Trading in wide industrial cotton goods was sporadic throughout the period, with most purchases consisting of fill-ins for spot or nearby delivery. Fair-sized quantities of chafer fabrics and hose and belting ducks were sold early in the period for delivery through June at unchanged prices. A general market weakness was evident in the middle of May despite some price reductions on drills, osnaburgs, and ducks. Indications are that third-quarter delivery prices for most constructions will be slightly below current levels.

Cotton Fabrics

Drills

59-inch 1.85-yd.	*yd.*	$0.385 /	$0.39
2.25-yd.		.345 /	.35

Osnaburgs			
40-inch 2.11-yd.	yd.	$0.235	$0.24
3.65-yd.		.155	
Ducks			
38-inch 1.78-yd. S. F.	yd.	.3875	
2.00-yd. D. F.		.31	.315
51.5-inch. 1.35-yd. S. F.		.51⅛	
Hose and belting		.67	
Raincoat Fabrics			
Print cloth, 38½-inch, 64x60	yd.	.1525	.155
Sheeting, 48-inch, 4.17-yd.		.22⅝	
52-inch, 3.85-yd.		.245	
Chafer Fabrics			
14.30-oz./sq. yd. Pl.	lb.	.73	
11.65-oz./sq. yd. S.		.65	
10.80-oz./sq. yd. S.		.6875	
8.9-oz./sq. yd. S.		.70	
Other Fabrics			
Headlining, 68-inch, 1.45-yd., 2-ply	yd.	.5725	
64-inch, 1.25-yd., 2-ply		.63	.6325
Sateens, 53-inch, 1.32-yd.		.585	
58-inch, 1.21-yd.		.6275	.6375
Tire Cords			
K. P. std., 12-4-2	lb.	nom.	

RAYON

TOTAL shipments of rayon by domestic producers during April amounted to 109,300,000 pounds, a decrease of 700,000 pounds from the preceding month's figure. Shipments of viscose high-tenacity yarn totaled 40,000,000 pounds during April, or 2,600,000 pounds below the March level. Calculated production of high-tenacity yarn during April was 39,700,000 pounds, or 99% of rated capacity, as compared with 41,900,000 pounds and 103% during March.

First-quarter production of viscose high-tenacity yarn totaled 117,000,000 pounds, an increase of 12,600,000 over that of the fourth quarter of 1952. Shipments of yarn for use in tires and related products during the first quarter amounted to 115,800,000 pounds, as compared with 102,700,000 pounds during the preceding quarter.

No changes were made in rayon tire cord and fabric prices during the period from April 16 to May 16, and current prices follow:

Rayon Prices

Tire Yarns

1100/ 480	$0.63
1100/ 490	.62
1150/ 490	.62
1650/ 720	.62
1650/ 980	.61
1900/ 980	.61
2200/ 960	.61
2200/ 980	.60
4400/2934	.63

Tire Fabrics

1100/490/2		.72
1650/980/2	$0.659 /	.73
2200/980/2		.685

United States Rubber Statistics—February, 1953

(All Figures in Long Tons, Dry Weight)

	New Supply			Distribution		Month-End
	Production	Imports	Total	Consumption	Exports	Stocks
Natural rubber, total	0	42,116	42,116	39,589	981	87,246
Latex, total	0	6,339	6,339	5,642	0	6,905
Rubber and latex, total	0	48,455	48,455	45,231	981	94,151
Synthetic rubbers, total	*58,946 †8,024	1,240	68,210	68,888	1,262	114,099
GR-S types‡	*53,333 †34	1,115	54,482	55,480	458	81,550
Butyl	*5,613	125	5,738	7,016	114	19,560
Neoprene‡	†6,619	0	6,619	5,122	566	9,078
Nitrile types‡	†1,371	0	1,371	1,270	124	3,911
Natural rubber and latex, and synthetic rubbers, total	66,970	49,695	116,665	114,119	2,243	208,250
Reclaimed rubber, total	24,373	210	24,583	24,098	950	30,631
GRAND TOTALS	91,343	49,905	141,248	138,217	3,193	238,881

*Government-plant production.
†Private-plant production.
‡Includes latices.
SOURCE: Rubber Division, NPA, United States Department of Commerce, Washington, D. C.

Estimated Automotive Pneumatic Casings and Tubes — Shipments, Production, Inventory, March, February, 1953; First Three Months, 1953, 1952

	March, 1953	% of Change from Preceding Month	February, 1953	1953 First Three Months	1952 First Three Months
Passenger Casings					
Shipments					
Original equipment	3,039,179		2,763,890	8,366,488	5,457,826
Replacement	3,793,074		3,160,616	10,869,604	9,411,202
Export	41,494		28,262	102,846	157,593
TOTAL	6,873,747	+15.47	5,952,768	19,338,938	15,026,621
Production	7,918,828	+15.65	6,847,398	21,590,323	18,600,134
Inventory end of month	13,364,093	+8.56	[illegible],653	13,364,093	10,558,217
Truck and Bus Casings					
Shipments					
Original equipment	530,874		498,892	1,470,231	1,451,374
Replacement	803,252		734,664	2,415,861	2,075,404
Export	47,404		56,841	155,103	291,805
TOTAL	1,381,530	+7.06	1,290,397	4,041,195	3,818,583
Production	1,487,707	+7.10	1,389,055	4,290,652	4,520,770
Inventory end of month	3,091,734	+3.59	2,984,510	3,091,734	2,484,877
Total Automotive Casings					
Shipments					
Original equipment	3,570,053		3,262,782	9,836,719	6,909,200
Replacement	4,596,326		3,895,280	13,285,465	11,486,606
Export	88,898		85,103	257,949	449,398
TOTAL	8,255,277	+13.97	7,243,165	23,380,133	18,845,204
Production	9,406,535	+14.21	8,236,453	25,880,975	23,120,904
Inventory end of month	16,455,827	+7.59	15,295,163	16,455,827	13,043,094
Passenger and Truck and Bus Tubes					
Shipments					
Original equipment	3,570,595		3,261,469	9,844,145	6,912,357
Replacement	2,945,710		3,051,625	10,473,999	8,248,699
Export	44,422		50,576	144,087	313,914
TOTAL	6,560,727	+3.10	6,363,670	20,462,231	15,474,970
Production	7,469,623	+16.21	6,427,551	20,027,408	16,217,039
Inventory end of month	11,241,817	+9.06	10,307,944	11,241,817	10,899,550

NOTE: Cumulative data on this report include adjustments made in prior months.
SOURCE: The Rubber Manufacturers Association, Inc., New York, N. Y.

United States Rubber Industry Employment, Wages, Hours

	Prod. Workers 1000's	Ave. Week Earnings	Ave. Week Hrs.	Ave. Hour Earnings	Consumers Price Index
All Rubber Products					
1939	121	$27.84	39.9	$0.745	—
1949	186	57.79	38.3	1.509	101.8
1950	203	64.42	40.9	1.575	102.8
1951	219	68.70	40.6	1.692	111.0
1952					
Jan.	218	74.91	40.9	1.814	113.1
Feb.	215	73.31	40.5	1.810	112.4
Mar.	215	72.58	40.3	1.801	112.4
April	213	71.40	39.6	1.803	112.9
May	213	73.47	40.5	1.814	113.0
June	215	75.01	40.9	1.834	113.4
July	201	72.15	39.6	1.822	114.1
Aug.	212	73.65	40.6	1.814	114.3
Sept.	217	75.17	41.1	1.829	114.1
Oct.	222	75.61	41.5	1.822	114.2
Nov.	227	77.44	41.3	1.875	114.3
Dec.	230	79.63	42.0	1.896	114.1
Tires and Tubes					
1939	54.2	$33.36	35.0	$0.957	
1949	83.6	63.26	36.4	1.738	
1950	87.8	72.48	39.8	1.821	
1951	90.8	77.93	39.6	1.968	
1952					
Jan.	94.4	86.99	40.9	2.127	
Feb.	94.2	85.75	40.6	2.112	
Mar.	93.9	83.46	39.8	2.097	
Apr.	94.6	81.90	39.3	2.084	
May	94.6	84.96	40.4	2.103	
June	95.3	87.79	41.1	2.136	
July	93.4	84.22	39.8	2.116	
Aug.	92.3	85.29	40.5	2.106	
Sept.	93.8	86.24	40.7	2.119	
Oct.	94.1	86.04	40.7	2.114	
Nov.	94.6	88.02	40.3	2.184	
Dec.	95.8	90.59	40.9	2.215	
Rubber Footwear					
1939	14.8	$22.80	37.5	$0.607	
1949	21.6	48.94	38.6	1.268	
1950	20.6	52.21	40.1	1.302	
1951	25.3	57.81	41.0	1.410	
1952					
Jan.	25.4	60.27	40.1	1.503	
Feb.	24.7	60.46	39.8	1.519	
Mar.	24.2	61.51	40.2	1.530	
Apr.	22.0	59.42	39.3	1.512	
May	23.5	60.69	39.9	1.521	
June	23.7	61.38	40.3	1.523	
July	19.0	58.83	39.3	1.497	
Aug.	24.0	61.93	40.4	1.533	
Sept.	24.8	63.03	40.9	1.541	
Oct.	25.7	63.71	41.1	1.550	
Nov.	26.0	68.71	42.0	1.636	
Dec.	26.5	66.99	41.3	1.622	
Other Rubber Products					
1939	51.9	$23.34	38.9	$0.605	
1949	80.9	54.38	40.1	1.356	
1950	94.3	59.76	42.2	1.416	
1951	102.9	63.26	41.4	1.528	
1952					
Jan.	97.9	65.63	41.2	1.593	
Feb.	96.3	64.43	40.6	1.587	
Mar.	97.2	64.83	40.8	1.589	
Apr.	96.3	63.68	39.9	1.596	
May	95.0	65.32	40.8	1.601	
June	95.7	65.73	40.9	1.607	
July	89.8	62.29	39.4	1.581	
Aug.	95.5	65.44	40.8	1.604	
Sept.	98.8	67.65	41.5	1.630	
Oct.	102.6	68.95	42.3	1.630	
Nov.	106.2	70.26	42.1	1.669	
Dec.	107.5	73.01	43.2	1.690	

SOURCE: BLS, United States Department of Labor, Washington, D. C.

COMPOUNDING INGREDIENTS*

Abrasives

Pumicestone, powdered	lb.	$0.025 /	$0.045
Rottenstone, domestic	lb.	.0175 /	.02

Accelerators, Organic

A-10	lb.	.40 /	.47
A-19	lb.	.52 /	.58
A-32	lb.	.61 /	.68
A-77	lb.	.47 /	.60
A-100	lb.	.47 /	.60
Accelerator 8	lb.	1.015	
49	lb.	.495 /	.505
552	lb.	2.07	
808	lb.	.61 /	.63
833	lb.	1.17 /	1.19
Altax	lb.	.435 /	.46
Arazate	lb.	2.235	
Beutene	lb.	.61 /	.66
Bismate	lb.	3.00	
B-J-F	lb.	.27 /	.32
Butasan	lb.	1.035	
Butazate	lb.	1.035	
Butyl Accelerator 21	lb.	.875 /	.88
Eight	lb.	1.10 /	1.35
Zimate	lb.	1.035	
Captax	lb.	.34 /	.36
C-P-B	lb.	1.95	
Cumate	lb.	1.45	
Diesterex N	lb.	.50 /	.57
DOTG (diorthotolylguanidine)	lb.	.52 /	.55
DGP (diphenylguanidine)	lb.	.43 /	.505
El-Sixty	lb.	.465 /	.535
Ethasan	lb.	1.035	
Ethazate	lb.	1.035	
Ethyl Thiurad	lb.	1.035	
Tuads	lb.	1.035	
Tuex	lb.	1.035	
Zimate	lb.	1.035	
Ethylac	lb.	.91 /	.93
Good-rite Erie	lb.	.35 /	.37
Hepteen	lb.	.435 /	.495
Base	lb.	1.80 /	1.90
Ledate	lb.	1.00	
M-B-T	lb.	.35 /	.40
-XXX	lb.	.455 /	.475
M-B-T-S	lb.	.42 /	.485
Merac	lb.	.75 /	1.03
Mertax	lb.	.455 /	.525
Methasan	lb.	1.035	
Methazate	lb.	1.035	
Methyl Tuads	lb.	1.135	
Zimate	lb.	1.035	
Monex	lb.	1.135	
Mono-Thiurad	lb.	1.135	
Morfex	lb.	.61 /	.66
NOBS No. 1	lb.	.68 /	.70
O-X-A-F	lb.	.445 /	.495
Pentex	lb.	1.035	
Flour	lb.	.20	
Permalux	lb.	2.17	
Phenex	lb.	.49 /	.54
Pip-Pip	lb.	2.07	
R-2 Crystals	lb.	2.20	
Rotax	lb.	.455 /	.475
S. A. 52	lb.	1.135	
57, 62, 67, 77	lb.	1.035	
66	lb.	1.50	
Santocure	lb.	.68 /	.75
Selenac	lb.	1.50	
Setsit No. 5	lb.	.75 /	1.05
SPDX-GH	lb.	.64 /	.69
GL	lb.	.95	
Tellurac	lb.	1.45	
Tepidone	lb.	.45 /	.48
Tetrone A	lb.	1.91	
Thiocarbanilide (A-1)	lb.	.48 /	.55
Thiofide	lb.	.435 /	.505
S	lb.	.465 /	.535
Thionex	lb.	1.135	
Thiotax	lb.	.35 /	.42
Thiurad	lb.	1.135	
Thiuram E	lb.	1.035	
M	lb.	1.135	
Trimene	lb.	.56 /	.66
Base	lb.	1.03 /	1.18
Tuex	lb.	1.135	
2-MT	lb.	.775	
Ultex	lb.	1.00 /	1.10
Unads	lb.	1.135	
Ureka Base	lb.	.66 /	.73
Z-B-X	lb.	2.45	
Zenite	lb.	.435 /	.455
A	lb.	.515 /	.535
Special	lb.	.445 /	.465
Zetax	lb.	.445 /	.465

Accelerator-Activators, Inorganic

Lime, hydrated	ton	10.00 /	17.50
Litharge, comml.	lb.	.16 /	.161
Eagle, sublimed	lb.	.16 /	.161
National Lead	lb.	.16 /	.161
Red Lead, comml	lb.	.17 /	.1725
Eagle	lb.	.17	
National Lead	lb.	.17 /	.1725
White lead, basic	lb.	.1525 /	.1625
Eagle, National Lead	lb.	.1525 /	.1625
White lead, silicate	lb.	.1475 /	.18
Eagle	lb.	.1625 /	.18
National Lead	lb.	.1475 /	.1575
Zinc oxide, comml. †	lb.	.14 /	.1725

Accelerator-Activators, Organic

Aktone	lb.	$0.22 /	$0.23
Barak	lb.	.62	
Curade	lb.	.57 /	.59
D-B-A	lb.	1.95	
Delac P	lb.	.45 /	.52
Emersol 110	lb.	.11 /	.1225
120	lb.	.115 /	.1275
130	lb.	.1375 /	.15
210 Elaine	lb.	.1075 /	.1375
Emery 600	lb.	.1075 /	.1375
Guantal	lb.	.55 /	.62
Hyfac 430	lb.	.14 /	.1525
431	lb.	.16 /	.1725
Laurex	lb.	.30 /	.33
MODX-B	lb.	.295 /	.345
NA-22	lb.	1.50	
Palmalene	lb.	.35	
Plastone	lb.	.27 /	.30
Polyac	lb.	1.655	
Ridacto	lb.	.25 /	.26
Seedine	lb.	.1485 /	.1705
SOAC-KL	lb.	.065 /	.09
Stearex Beads	lb.	.14⅞ /	.15⅞
Stearic acid, single pressed	lb.	.11 /	.1225
Double pressed	lb.	.115 /	.1275
Triple pressed	lb.	.1375 /	.15
Stearite	lb.	.095 /	.10
Tonox	lb.	.515 /	.605
Zinc stearate	lb.	.37 /	.39

Alkalies

Caustic soda, flake	100 lbs.	3.75 /	.677
Liquid, 50%	100 lbs.	2.55 /	2.75
Solid	100 lbs.	3.35 /	5.05

Antioxidants

AgeRite Alba	lb.	2.275 /	2.375
Gel	lb.	.62 /	.64
H. P.	lb.	.695 /	.715
Hipar	lb.	.94 /	.96
Powder	lb.	.505 /	.525
Resin	lb.	.67 /	.69
D	lb.	.505 /	.525
Stalite	lb.	.505 /	.525
White	lb.	1.45 /	1.55
Akroflex C	lb.	.695 /	.715
CD	lb.	.695 /	.715
Albasan	lb.	.69 /	.73
Aminox	lb.	.505 /	.595
Antioxidant 2246	lb.	1.65 /	1.68
Antisol	lb.	.23 /	.24
Antox	lb.	.505 /	.525
Aranox	lb.	3.25	
Betanox Special	lb.	.725 /	.815
B-L-E, -25	lb.	.505 /	.595
Burgess Antisun Wax	lb.	.185	
B-X-A	lb.	.505 /	.595
Copper Inhibiter X-872-L	lb.	2.105	
Flectol H	lb.	.505 /	.575
Flexamine	lb.	.695 /	.785
Heliozone	lb.	.26 /	.27
Ionol	lb.	.91 /	1.40
NBC	lb.	1.55	
Neozone A	lb.	.525 /	.545
C	lb.	.695	
D	lb.	.505 /	.525
Octamine	lb.	.505 /	.595
Perflectol	lb.	.61 /	.68
Rio Resin	lb.	.54 /	.56
Santoflex 35	lb.	.695 /	.765
AW	lb.	.75 /	.82
B	lb.	.505 /	.575
BX	lb.	.62 /	.69
Santovar A	lb.	1.50 /	1.57
O	lb.	1.30 /	1.37
Santowhite Crystals	lb.	1.60 /	1.67
L	lb.	.505 /	.575
MK	lb.	1.29 /	1.36
S.C.R.	lb.	.32 /	.34
Sharples Wax	lb.	.23 /	.28
Stabilite	lb.	.53 /	.57
Alba	lb.	.72 /	.79
L	lb.	.60 /	.64
White	lb.	.53 /	.62
Powder	lb.	.41 /	.47
Sunolite	lb.	.20	
Sunproof	lb.	.25 /	.30
Improved	lb.	.23 /	.28
Jr.	lb.	.18 /	.23
Thermoflex A	lb.	.98 /	1.00
Tonox	lb.	.50 /	.5975
Tysonite	lb.	.24 /	.2475
V-G-B	lb.	.67 /	.76
Wing-Stay S	lb.	.495 /	.505
Zenite	lb.	.33 /	.35

Antiseptics

Copper naphthenate, 6-8%	lb.	.2275	
Pentachlorophenol	lb.	.21 /	.29
Resorcinol, technical	lb.	.775 /	.785
Zinc naphthenate, 8-10%	lb.	.235 /	.285

*Prices in general are f.o.b. works. Range indicates grade or quantity variations. Space limitation prevents listing of all known ingredients. Prices are not guaranteed; contact suppliers for spot prices.

†For trade names see Color—White, Zinc Oxides.

‡At the request of the suppliers, the lowest prices shown for carbon blacks are for carloads in bags. Prices for hopper carloads are lower.

Blowing Agents

Ammonium, bicarbonate	lb.	$0.06 /	$0.07
Carbonate	lb.	.23 /	.24
Blowing Agent CP-975	lb.	.35	
Celogen	lb.	1.95	
50-C	lb.	1.01	
Sodium bicarbonate	100 lbs.	2.10 /	3.15
Carbonate, tech.	100 lbs.	1.20 /	5.02
Unicel	lb.	.82	
ND	lb.	1.11	
S	lb.	.20	

Bonding Agents

G-E Silicone Paste SS-15	lb.	4.52 /	5.10
SS-64	lb.	3.65 /	6.75
-67 Primer	lb.	7.50 /	12.50
Gen-Tac Latex	lb.	.75 /	.855
Kalabond Adhesive	gal.	6.50 /	16.00
Tie Cement	gal.	2.00 /	5.60
MDI	lb.	4.00 /	6.00
-50	lb.	2.00 /	3.00
Thixons	gal.	1.48 /	12.00
Ty-Ply BN, Q, S, 3640	gal.	6.75 /	8.00

Brake Lining Saturants

BRT 3	lb.	.018 /	.0265
Resinex L-S	lb.	.0225 /	.03

Carbon Blacks‡

Conductive Channel—CC

Continental R-20	lb.	.15 /	.22
R-40	lb.	.18 /	.24
Kosmos/Dixie BB	lb.	.195 /	.25
Spheron C	lb.	.14 /	.185
I	lb.	.12 /	.165
N	lb.	.25 /	.29
Voltex	lb.	.18 /	.315

Easy Processing Channel—EPC

Continental AA	lb.	.074 /	.1225
Kosmobile 77/Dixiedensed 77	lb.	.074 /	.1225
Micronex W-6	lb.	.074 /	.1225
Spheron #9	lb.	.074 /	.1225
Texas E	lb.	.074 /	.1175
Witco #12	lb.	.074 /	.1225
Wyex	lb.	.074 /	.12

Hard Processing Channel—HPC

Continental F	lb.	.074 /	.1225
HX	lb.	.074 /	.12
Kosmobile S/Dixiedensed S	lb.	.074 /	.1225
Micronex Mk. II	lb.	.074 /	.1225
Spheron #4	lb.	.074 /	.1225
Witco #6	lb.	.074 /	.1225

Medium Processing Channel—MPC

Arrow TX	lb.	.074 /	.12
Continental A	lb.	.074 /	.1225
Kosmobile S-66/Dixiedensed S-66	lb.	.074 /	.1225
Micronex Standard	lb.	.074 /	.1225
Spheron #6	lb.	.074 /	.1225
Texas M	lb.	.074 /	.1175
Witco #1	lb.	.074 /	.1225

Conductive Furnace—CF

Aromex 115	lb.	.089 /	.129
Vulcan C	lb.	.11 /	.153

Fast Extruding Furnace—FEF

Arovel	lb.	.06 /	.10
Kosmos 50/Dixie 50	lb.	.06 /	.10
Statex M	lb.	.06 /	.10
Sterling SO	lb.	.06 /	.10

Fine Furnace—FF

Statex B	lb.	.065 /	.105
Sterling 99	lb.	.065 /	.105

High Abrasion Furnace—HAF

Aromex	lb.	.079 /	.125
Continex HAF	lb.	.079 /	.125
Kosmos 60/Dixie 60	lb.	.079 /	.1175
Philblack O	lb.	.079 /	.119
Statex R	lb.	.079 /	.125
Vulcan #3	lb.	.079 /	.122
6	lb.	.11 /	.153

Medium Abrasion Furnace—MAF

Philblack A	lb.	.06 /	.10

Super Abrasion Furnace—SAF

Philblack E	lb.	.135 /	.175
Statex 125	lb.	.11 /	.155
Vulcan 9	lb.	.135 /	.178

General-Purpose Furnace—GPF

Sterling V	lb.	.05 /	.09

High Modulus Furnace—HMF

Continex HMF	lb.	.055 /	.095
Kosmos 40/Dixie 40	lb.	.055 /	.095
Modulex	lb.	.055 /	.095
Statex 93	lb.	.055 /	.095
930	lb.	.047 /	.087
Sterling L, LL	lb.	.055 /	.095

Semi-Reinforcing Furnace—SRF

Continex SRF	lb.	$0.04	$0.08
Essex	lb.	.04	.08
Furnex	lb.	.04	.08
Gastex	lb.	.045	.085
Kosmos 20/Dixie 20	lb.	.04	.08
Pelletex, NS	lb.	.04	.08
Sterling NS, S	lb.	.04	.08
R	lb.	.045	.085

Fine Thermal—FT

P-33	lb.	.055	

Medium Thermal—MT

Sterling MT	lb.	.035	.045
Thermax	lb.	.035	
Stainless	lb.	.045	

Chemical Stabilizers

Advastab-21	lb.	1.06	1.12
Argus stabilizers	lb.	.60	1.38
Dutch Boy DS-207	lb.	.53	.55
Dyphos	lb.	.56	.58
Dythal	lb.	.40	.42
Normasal	lb.	.45	.47
Plumb-O-Sil A	lb.	.2875	.3075
B	lb.	.3025	.3225
C	lb.	.3325	.3525
Tribase	lb.	.265	.285
E	lb.	.235	.255
Eagle Basic Silicate White			
Lead 201	lb.	.17	.18
202	lb.	.1625	.1725
Stabelans	lb.	.60	1.70
Stabilizer #3, #52	lb.	2.10	2.20
143	lb.	.80	.90
B-5	lb.	.70	.75
BC-12	lb.	.90	.95
CH-14	lb.	.65	.70
E-6-B	lb.	.90	1.00
JCX	lb.	.67	.76
L Paste	lb.	.60	.65
SN	lb.	.47	.53
V-I-N	lb.	.42	.50
Dry Powder	lb.	.75	.80
V-9	lb.	.85	.90
VL-2	lb.	1.26	1.32
-3	lb.	1.17	1.23
Staycin 1	lb.	.65	
Vanstay H	lb.	.75	.77
HH	lb.	.98	
L	lb.	.33	.35
Witco Lead Stearate #50	lb.	.56	
Stabilizer #70	lb.	.70	

Colors

Black

Black Paste #25	lb.	.22	.40
BK Iron Oxides	lb.	.1175	.12
Covinylblaks	lb.	.62	1.145
Ivo Bone Blacks	lb.	.15	.2025
Lampblack, comml	lb.	.16	.45
Superjet	lb.	.0825	.1175
Mapico	lb.	.1175	.12
MB Mineral Blacks	lb.	.0315	.0675
Stan-Tone	lb.	.45	1.20

Blue

Du Pont	lb.	1.77	4.55
Heveatex pastes	lb.	.80	1.45
Stan-Tone	lb.	1.55	1.60
Toners	lb.	.30	3.50

Brown

Brown Paste #5, #10	lb.	.35	.45
Mapico	lb.	.1275	.13
Tan	lb.	.1975	.20
Metallic brown	lb.	.035	.045
Plastics brown	lb.	.0625	.07
Sienna, burnt	lb.	.0425	.155
Raw	lb.	.045	.1325
Umber, burnt	lb.	.06	.065
Raw	lb.	.0625	.065

Green

Chrome	lb.	.17	.40
Oxide	lb.	.375	1.20
Du Pont	lb.	1.85	3.20
G-4099, -6099	lb.	.34	.345
7599	lb.	.405	.41
GH-9869	lb.	.85	1.00
9976	lb.	.95	1.10
Heveatex pastes	lb.	.95	1.85
Stan-Tone	lb.	1.75	4.60
Toners	lb.	.35	4.00

Orange

Du Pont	lb.	2.75	
Orange Paste #13	lb.	1.35	1.50
Stan-Tone	lb.	.70	3.35
Toners	lb.	.30	1.50

Red

Antimony trisulfide	lb.	.38	.385
R. M. P. No. 3	lb.	.72	
Sulfur Free	lb.	.78	
Cadmium red lithopone	lb.	1.64	2.05
Cadmolith	lb.	1.72	2.05
Du Pont	lb.	1.32	1.80
Indian Red	lb.	.1225	.125
Iron oxide, red	lb.	.06	.13
Mapico	lb.	.1225	.125
Red Paste #17, I-2	lb.	.95	1.10
Rub-Er-Red	lb.	.0975	
Stan-Tone	lb.	1.05	4.05
Toners	lb.	.25	4.15

White

Antimony oxide	lb.	$0.275	$0.395
Burgess Iceberg	ton	50.00	
Lithopone, titanated	lb.	.10	.11
Cryptone BT	lb.	.10	.11
Titanium pigments			
Rayox LW	lb.	.195	.205
R-110	lb.	.215	.225
Ti-Cal	lb.	.075	.0825
Ti-Pure	lb.	.195	.225
Titanox A-168, -LO, -MO	lb.	.21	.22
RA, RA-10	lb.	.23	.24
RCHT	lb.	.08	.085
Zopaque	lb.	.21	.22
Zinc oxide, comml	lb.	.14	.1725
Azo ZZZ-11, -44, -55	lb.	.14	.15
35% leaded	lb.	.14	.15
50% leaded	lb.	.14	.15
Eagle AAA, lead free	lb.	.14	.15
5% leaded	lb.	.14	.15
35% leaded	lb.	.14	.15
50% leaded	lb.	.14	.15
Florence Green Seal	lb.	.1575	.1675
Red Seal	lb.	.1525	.1625
White Seal	lb.	.1625	.1725
Horsehead XX-4, -78	lb.	.14	.15
Kadox -15, -17, -22	lb.	.14	.15
-25	lb.	.1625	.1725
Lehigh, 35% leaded	lb.	.14	.15
50% leaded	lb.	.14	.15
Protox-166, -167	lb.	.14	.15
St. Joe, lead free	lb.	.14	.15
Zinc sulfide, comml	lb.	.253	.263
Cryptone ZS	lb.	.253	.263

Yellow

Cadmium yellow lithopone	lb.	1.20	1.21
Cadmolith	lb.	1.29	1.37
Chrome	lb.	.31	.33
Du Pont	lb.	1.62	2.15
Iron oxide, yellow	lb.	.038	.1075
Mapico	lb.	.10	.1025
Stan-Tone	lb.	1.00	1.55
Toners	lb.	.50	1.37
Yellow D	lb.	1.25	1.35

Dispersing Agents

Darvan Nos. 1, 2	lb.	.22	.30
Daxads	lb.	.08	.35
Kreelons	lb.	.15	.16
Modicols	lb.	.17	.58
Triton R-100	lb.	.12	.25

Dusting Agents

Extrud-o-Lube, conc.	gal.	1.54	
Glycerized Liquid Lubricant, concentrated	gal.	1.48	
Lubrex	lb.	.25	.30
Mica	lb.	.075	.085
Polymel D-Tac	lb.	.21	.22
Pyrax A	ton	13.50	
W. A.	ton	16.00	
Snow Crest Talc	ton	33.00	35.00
Vanfre	gal.	2.00	2.50

Extenders

Advagum 1098	lb.	.61	.69
BRS 700	lb.	.02	.0285
BRT 7	lb.	.03	.031
Burgess MX-50	ton	150.00	
Car-Bel-Ex A	lb.	.14	
Dielex B	lb.	.06	
Factice, Amberex	lb.	.29	.36
Brown	lb.	.1425	.268
Naophax	lb.	.157	.268
White	lb.	.144	.285
Mineral Rubbers			
Black Diamond	ton	38.00	40.00
Extender 600	lb.	.185	
Hard Hydrocarbon	ton	46.50	48.50
No. 38	ton	38.00	40.00
Parmr	ton	21.00	29.00
Nuba No. 1, 2	lb.	.0575	.0625
3X	lb.	.0775	.0825
Polymel Sublac Resins	lb.	.26	.30
Rubber substitute, brown	lb.	.137	.2625
White	lb.	.156	.292
Stan-Shells	ton	35.00	73.00
Synthetic 100	lb.	.41	

Fillers, Inert

Barytes, floated, white	ton	41.60	60.10
Off-color, domestic	ton	20.00	
No. 1	ton	37.60	53.60
2	ton	35.60	51.60
Blanc fixe	ton	100.00	155.00
Clays			
Aiken	ton	14.00	
Albacar	ton	50.00	55.00
Aluminum Flake	ton	20.00	60.00
#5	ton	23.50	26.50
#10	ton	20.00	22.50
Champion	ton	14.00	
Crown	ton	14.00	33.00
GK Soft Clay	ton	11.00	
Hi-White R	ton	13.50	
Hydratex R	ton	28.00	
Paragon	ton	13.50	31.50
McNamee	ton	13.50	
RX-43	ton	33.00	
Stan-Clay	ton	28.00	
Stellar-R	ton	50.00	
Suprex	ton	14.00	32.00
W-1291 English	ton	53.00	55.00
Witco #1	ton	14.00	30.00
#2	ton	13.50	30.00
Cryptone BA, CB, MS	lb.	$0.08	$0.0825
Flocks			
Cotton, dark	lb.	.095	.112
Dyed	lb.	.55	.60
White	lb.	.13	.33
Fabrifil X-24-G	lb.	.095	
X-24-W	lb.	.135	
Filfloc 6000	lb.	.16	
F-40-900	lb.	.105	
Solka-Floc	lb.	.07	.16
Kalite	ton	50.00	65.00
Lithopone, comml	lb.	.075	.085
Albalith	lb.	.075	.085
Astrolith	lb.	.06⅜	.0675
Eagle	lb.	.0725	.075
Sunolith	lb.	.079	.089
Mica	lb.	.075	.085
Millical	ton	32.50	47.50
No. 1 Silica	ton	22.00	40.00
Non-Fer-Al	ton	25.00	40.00
Purecal D	ton	50.00	65.00
M	ton	45.00	65.00
T	ton	110.00	125.00
Pyrax A	ton	12.50	
W. A.	ton	15.00	
SL Slate Flour	ton	17.00	25.00
Stan-White	ton	8.50	9.45
Super-White Silica	ton	23.00	42.00
Suspenso	ton	30.00	45.00
Terra Alba 1319	ton	27.00	
Ti-Cal	lb.	.0675	
Whiting, limestone	ton	6.00	15.00
Calcite	ton	20.00	
Paxinosa	ton	10.00	18.00
Witco	ton	8.50	

Finishes

Black-out	gal.	4.50	8.00
Flocks			
Cotton, dark	lb.	.095	.112
Dyed	lb.	.55	.60
White	lb.	.13	.33
Rayon, colored	lb.	.90	1.50
White	lb.	.75	1.25
Rubber lacquer, clear	gal.	1.00	2.00
Colored	gal.	2.00	3.50
Shoe varnish	gal.	1.45	
Talc	ton	14.00	38.50
Nytals	ton	25.00	36.00
Wax, Bees	lb.	.46	59.00
Carnauba	lb.	1.10	1.38
Montan	lb.	.125	.32
No. 118, colors	gal.	.86	1.41
Neutral	gal.	.76	1.31
Van Wax	gal.	1.45	1.50

Latex Compounding Ingredients

Accelerator 552	lb.	2.07	
J-127, -132	lb.	1.00	1.15
Aerosol	lb.	.35	
AgeRite Dispersions	lb.	.60	2.25
Alcogum AN-10	lb.	.085	
Amberex Solutions	lb.	.1675	.18
Antifoam J-114	lb.	3.25	3.45
P-242	lb.	.24	.35
Antioxidant J-105	lb.	1.90	2.05
-126, -139	lb.	1.45	1.60
-137, -140	lb.	.55	.70
-138	lb.	1.05	1.20
-191	lb.	1.10	1.20
Anti-Webbing Agent X-452	lb.	.75	.90
Aquablaks	lb.	.08	.1775
Aquarex D	lb.	.80	
G	lb.	.21	
L	lb.	.94	
MDL	lb.	.33	
ME	lb.	.97	
NS	lb.	.60	
SMO	lb.	.50	
WAQ	lb.	.28	
Areskap 50	lb.	.30	.38
100, dry	lb.	.60	.72
Aresket 240	lb.	.30	.38
300, dry	lb.	.60	.72
Aresklene 375	lb.	.42	.57
Black No. 25, dispersed	lb.	.22	
Casein	lb.	.275	.385
Coagulant P-379	gal.	1.30	1.90
-392	gal.	1.55	2.15
CW-12	lb.	.85	
37	lb.	.70	
Darex Copolymer Latices	lb.	.365	.50
Dispersed Sulfur No. 2	lb.	.10	.12
Factice dispersions	lb.	.26	.42
Gelling Agent P-397	lb.	.34	.37
Habuco Resin Emulsion			
#226	lb.	.227	.232
2246-A	lb.	.275	.28
3408-B	lb.	.18	.19
Laton L	lb.	.075	.0775
Ludox	lb.	.1675	.1925
Marmix	lb.	.41	.48
Micronex, colloidal	lb.	.06	.07
Pliolite Latex 150, 190	lb.	.32	.41
170	lb.	.37	.46
Resin Emulsion A-2	lb.	.16	.25
A-155TH	lb.	.195	.265
P-370	lb.	.125	.175
X-210	lb.	.12	.32
Resin V	lb.	.13	
Santomerse D	lb.	.44	.65
S	lb.	.13	.25
Stablex A	lb.	.80	1.10
B, G	lb.	.50	.95
K	lb.	.27	.35
P	lb.	.35	.50
T	lb.	.17	.22
Sulfur dispersions	lb.	.12	.25
Webnix #34	lb.	1.50	2.25

CLASSIFIED ADVERTISEMENTS

ALL CLASSIFIED ADVERTISING MUST BE PAID IN ADVANCE

Effective July 1, 1947

GENERAL RATES	SITUATIONS WANTED RATES	SITUATIONS OPEN RATES
Light face type $1.25 per line (ten words)	Light face type 40c per line (ten words)	Light face type $1.00 per line (ten words)
Bold face type $1.60 per line (eight words)	Bold face type 55c per line (eight words)	Bold face type $1.40 per line (eight words)
Allow nine words for keyed address.		*Letter replies forwarded without charge, but no packages or samples.*

Address All Replies to New York Office at 386 Fourth Avenue, New York 16, N. Y.

SITUATIONS WANTED

ASSISTANT SALES MANAGER, SALES ENGINEER FOR INdustrial molded and extruded products, graduate Mech. Engineer licensed, 18 years' rubber sales experience, 10 in molded goods, broad knowledge products, specifications, costs, management, and advertising, seeks permanent position with future. Address Box No. 1313, care of INDIA RUBBER WORLD.

LATEX CHEMIST: B.S. ABOUT 5 YEARS' EXPERIENCE IN ALL phases of natural and synthetic latex compounding; production and some technical service. Presently employed; desires change to position with more responsibility. Will travel. Address Box No. 1314, care of INDIA RUBBER WORLD.

CHEMICAL ENGINEER — OVER 15 YEARS' EXPERIENCE various rubber compounding, processing, product sales, engineering and application, desires California connection with investment or as consultant technical director and management. Know western industrial market. Available Los Angeles vicinity early July. Address Box No. 1324, care of INDIA RUBBER WORLD.

SITUATIONS OPEN

RUBBER CHEMIST FOR DEVELOPMENT WORK, MUST BE experienced in compounding oil seals, "O" rings, and similar packings. Location is the Chicago area. All replies will be kept confidential. Our employes know of this advertisement. Address Box No. 1315, care of INDIA RUBBER WORLD.

CHEMICAL ENGINEER. YOUNG, 3 to 4 YEARS' EXPERIENCE with foam rubber processing. To develop foam rubber products and methods. Large corporation. Send complete résumé and salary requirements. Address Box No. 1316, care of INDIA RUBBER WORLD.

FOREMAN — RUBBER MILL ROOM. EXPERIENCED. FOR Mid-Atlantic states. Rubber reclaiming mill. Address Box No. 1317, care of India RUBBER WORLD.

LATEX SPONGE SUPERINTENDENT TO ASSIST IN ESTABlishing new company division in Illinois-Iowa area. Experienced in all phases of production of latex sponge. Interviews will be arranged promptly and on confidential basis. Please forward complete résumé. Address Box No. 1318, care of India RUBBER WORLD.

WANTED: MAN TO RUN NEW RUBBER FLOOR TILE PLANT, Chicago area. Must have experience. Address Box No. 1319, care of INDIA RUBBER WORLD.

SEAL ENGINEER. MIDWEST MECHANICAL MOLDED RUBber plant desires experienced Seal Engineer and Salesman to manage new seal division. Must be capable of designing and selling; as well as building seal organization as division expands. Exceptional opportunity on salary along with liberal bonus. All replies confidential. Address Box No. 1321, care of India RUBBER WORLD.

LATEX CHEMIST

For research and development work adhesives and coatings. Established California company. State age, experience, salary expected.

ADDRESS BOX NO. 1309, c/o INDIA RUBBER WORLD

FOOTWEAR RUBBER CHEMIST

Rubber chemist experienced in formulating footwear rubber compounds required to take charge of a control and development laboratory. Should be able to express himself in French. Salary commensurate with experience.

ADDRESS BOX NO. 1310, c/o INDIA RUBBER WORLD

SITUATIONS OPEN (Continued)

MATERIALS ENGINEER

Major chemical manufacturer seeks rubber materials engineer for midwest territory. Excellent opportunity for young man with college degree to join in market development in expanding field. Growing organization provides excellent future opportunities. Familiarity with rubber fabricating techniques and rubber parts specification procedures necessary. Travel required.

Please reply giving details of education, experience and salary requirements.

ADDRESS BOX NO. 1311,
c/o INDIA RUBBER WORLD

386 Fourth Avenue, New York 16, N. Y.

Exceptional opportunities now available with an Eastern Manufacturer of custom industrial adhesives that is completing plans for a plant in the Ohio-Indiana area.

***TECHNICAL SALES* with some factory and overall management control. Laboratory background in Rubber Chemistry desirable.**

***RUBBER CHEMIST* to work on development and service problems. Background in natural and synthetic rubber cements and adhesives desirable.**

Send full data on qualifications. Salaries open.

ADDRESS BOX NO. 1312,
c/o INDIA RUBBER WORLD

MACHINERY AND SUPPLIES FOR SALE

FOR SALE: 2 BALDWIN-SOUTHWARK 650-TON HYDRAULIC Presses, 27" x 27"; Ball & Jewell No. 1½ stainless steel rotary cutter; 4 Stokes D-3 rotary presses, 15-punch and 16-punch; 2 Kux No. 25 rotary presses; 4 Mikro pulverizers. Large stock stainless tanks and kettles. PERRY EQUIPMENT CORP., 1424 N. 6th St., Phila. 22, Pa.

FOR SALE: FARREL 16" x 48" AND 15" x 36", 2-ROLL RUBBER Mills, and other sizes up to 84". Also new lab. 6" x 12" & 6" x 16" Mixing Mills and Calenders. Extruders, 1" to 3". Baker-Perkins Mixers 100, 50, and 9 gals., heavy-duty double-arm. Ball & Jewell & Leominster Rotary Cutters. Brunswick 200-ton Hydraulic Presses 21" x 21" platens. Large stock of hydraulic presses from 12" x 12" to 48" x 48", platens from 50 to 2,000 tons. Hydraulic pumps and Accumulators. Crushers, Churns, Rubber Bale Cutters, etc. SEND FOR SPECIAL BULLETIN. WE BUY YOUR SURPLUS MACHINERY. STEIN EQUIPMENT CO., 107 — 8th St., Brooklyn 15, N. Y. STerling 8-1944.

(*Classified Advertisements Continued on Page 413*)

Mold Lubricants

Aquarex Compounds	lb.	$0.28 /	$0.97
Colite Concentrate	gal.	.90 /	1.15
ELA	lb.	.825	
DC Mold Release Fluid	lb.	4.14 /	6.00
Emulsion Nos. 35, 35A, 35B	lb.	1.46 /	3.50
DC 7	lb.	6.20 /	6.80
Glycerized Liquid Lubricant, concentrated	gal.	1.48	
Lubrex	lb.	.25 /	.30
Lubri-Flo	gal.	10.00 /	12.05
Mold Paste	lb.	.25	
Monten Wax	lb.	.57	
Para Lube	lb.	.046 /	.048
Rubber-Glo	gal.	.94 /	.97
Soap, Hawkeye	lb.	1.35 /	1.45
Purity	lb.	.155 /	.165
Sodium stearate	lb.	.43 /	.44
Stearite	lb.	.095 /	.10
Vanfre	gal.	2.50 /	3.00

Odorants

Alamasks	lb.	.75 /	6.50
Curodex 19	lb.	4.75	
188	lb.	5.75	
198	lb.	6.75	
Rodo No. 0	lb.	4.00 /	4.50
No. 10	lb.	5.00 /	5.50

Plasticizers and Softeners

Akroflex C	lb.	.695 /	.715
Aro Lene #1980	lb.	.10 /	.12
Baker AA Oil	lb.	.25 /	.31
Crystal O Oil	lb.	.265 /	.325
Processed oils	lb.	.27 /	.305
Bardol	lb.	.0275/	.0375
639	lb.	.0275/	.045
B	lb.	.0625/	.065
Bondogen	lb.	.55 /	.60
BRC 20	lb.	.15 /	.175
30	lb.	.0125/	.021
521	lb.	.019 /	.02
BRH 2	lb.	.0213/	.0351
BRS 700	lb.	.02 /	.0285
BRT 7	lb.	.03 /	.031
BRV	lb.	.0475/	.0565
Bunarex Liquid	lb.	.0425/	.0555
Resins	lb.	.065 /	.1225
Bunnatol G. S.	lb.	.40 /	.505
Butac	lb.	.125 /	.135
BxDC	lb.	.40 /	.41
Cabflex DCP	lb.	.35 /	.3775
DDA	lb.	.46 /	.4875
DDP	lb.	.38 /	.4075
Di-BA	lb.	.3925/	.42
OA	lb.	.43 /	.4575
OP	lb.	.37 /	.3975
Carbonex S	lb.	.0475/	.05
Chlorowax 40	lb.	.16 /	.17
Contogums	lb.	.0875/	.111
Cumar EX	lb.	.0525	
MH	lb.	.065 /	.11
V	lb.	.0975/	.1275
Darex Plasticizer DBM	lb.	.30 /	.3275
Dielex B	lb.	.06	
Dipolymer Oil	gal.	.33 /	.38
Dispersing Oil No. 10	lb.	.06 /	.0625
Duraplex C-50 LV, 100%	lb.	.25 /	.295
Dutrex 6	lb.	.025 /	.035
Fortex	lb.	.125 /	.145
Galex W-100	lb.	.135 /	.1725
W-100D	lb.	.1325/	.17
Gilsowax B	lb.	.09 /	.11
Good-rite GP-261	lb.	.40 /	.52
GP-263	lb.	.45 /	.585
Harchemex	lb.	.3025/	.39
Harflex 500	lb.	.36 /	.3875
Heavy Resin Oil	lb.	.0225/	.0375
HSC-13	lb.	.27 /	.30
Indoil Compound 51-S	lb.	1.00 /	1.10
Indonex	gal.	.11 /	.19
Marvinol plasticizers	lb.	.28 /	.8825
Morflex plasticizers	lb.	.35 /	.725
Nevillac	lb.	.31 /	.85
Neville R. Resins	lb.	.13 /	.35
Nevinol	lb.	.20	
No. 1-D heavy oil	lb.	.055 /	.065
Palmalene	lb.	.15	
Paraflex BN-1	lb.	.185 /	.225
Para Flux, regular	gal.	.1925/	.2125
No. 2016	gal.	.165 /	.24
2332	gal.	.11	
Para Lube	lb.	.046 /	.048
Resins	lb.	.04 /	.045
Paradene Resins	lb.	.065 /	.075
Peptizene #2	lb.	.90	
Pepton 22	lb.	.745 /	.775
Picco Resins	lb.	.13 /	.185
480 Oilproof Series	lb.	.18 /	.23
S. O. S.	gal.	.29 /	.34
Piccocizers	lb.	.04 /	.068
Piccolastic Resins	lb.	.1855/	.34
Piccolyte Resins	lb.	.185 /	.25
Piccopale Resins	lb.	.12 /	.135
Piccoumaron Resins	lb.	.07 /	.185
Piccovars	lb.	.145 /	.20
Piccovol	lb.	.025 /	.038
Pictar	gal.	.25 /	.30
Pigmentar	gal.	.041 /	.0678
Pigmentaroil	gal.	.041 /	.0678
Plasticizer 35	lb.	$0.205 /	$0.24
36	lb.	.305 /	.34
42	lb.	.34 /	.40
B	lb.	.35 /	.45
DP-520	lb.	.435 /	.455
MT-511	lb.	.535 /	.565
ODN	lb.	.32 /	.37
PX series	lb.	.385 /	.75
SC	lb.	.61 /	.69
Plastogen	lb.	.0775/	.08
Plastone	lb.	.22 /	.30
Polycizers	lb.	.40 /	.4775
Polymel 6	lb.	.07 /	.075
7	lb.	.14	
D Resin	lb.	.235 /	.24
Gilsowax B	lb.	.0925/	.1025
Resin C-130	lb.	.195 /	.205
PT67 Light Pine Oil	gal.	.60	
101 Pine Tar Oil	gal.	.3485/	.455
400 Light Pine Tar	gal.	.361 /	.47
600 Med. Pine Tar	gal.	.365 /	.475
800 Heavy Pine Tar	gal.	.369 /	.48
R-19, R-21 Resins	lb.	.1075/	
Reogen	lb.	.1325/	.135
Resin C pitch	lb.	.0225/	.031
R6-3	lb.	.38 /	.40
Resinex	lb.	.0325/	.0375
L-4	lb.	.0225/	.03
Rosin Oil, Sunny South	gal.	.58 /	.875
RPA No. 2	lb.	.775	
No. 3 RO	lb.	.49	
5	lb.	.57	
RSN Flux	gal.	.10 /	.19
Rubber Oil B-5	lb.	.0225/	.0355
Rubberol	lb.	.2575	
Santicizer 107	lb.	.40 /	.4775
140	lb.	.3525/	.43
141	lb.	.40 /	.4775
160	lb.	.33 /	.4075
Seedine	lb.	.1485/	.1705
Softener #20	gal.	.10 /	.20
Special Rubber Resin	100 lb.	.1675/	.2175
Starex Beads	lb.	.1474/	.1574
Starite	lb.	.095 /	.10
Syn-Tac	gal.	.33 /	.35
Synthol	lb.	.2475	
Thiokol TP-90B	lb.	.59 /	.69
-95, -98	lb.	.65	
TR-11	lb.	.035	
Turgum S	lb.	.1075/	.1175
Tysonite	lb.	.24 /	.2475
X-1 Resinous Oil	lb.	.021 /	.0275
XX-100 Resin	lb.	.0525	

Reclaiming Oils

Bardol	lb.	.0275/	.0375
639	lb.	.0275/	.045
B	lb.	.0625/	.065
BRH 2	lb.	.0213/	.0351
BRT 4	lb.	.025 /	.026
BRV	lb.	.0475/	.0565
Burco-RA	lb.	.055 /	.0825
BWH-1	lb.	.14	
Dipolymer Oil	gal.	.33 /	.43
Dispersing Oil No. 10	lb.	.06 /	.0625
Heavy Resin Oil	lb.	.0225/	.0375
LX-759	gal.	.16 /	.165
-774, -777	gal.	.23 /	.33
No. 1621	lb.	.025 /	.035
3186	gal.	.28 /	.295
Picco 6535	gal.	.25 /	.30
C-33	gal.	.215 /	.315
-42	gal.	.23 /	.33
D-4	gal.	.27 /	.37
E-5	gal.	.25 /	.35
O-Oil	gal.	.286 /	.36
PT 101 Pine Tar Oil	gal.	.3485/	.455
150 Pine Solvent	gal.	.44	
Reclaiming Oil #3186	gal.	.28 /	.385
-G	gal.	.25 /	.365
RR-10	lb.	.36	
S. R. O.	lb.	.015 /	.0225
X-1 Resinous Oil	lb.	.021 /	.03

Reinforcers, Other Than Carbon Black

BRC 20	lb.	.15 /	.175
30	lb.	.0125/	.021
521	lb.	.019 /	.02
Bunarex resins	lb.	.065 /	.1225
Calcene NC	ton	72.50 /	92.50
TM	ton	75.00 /	95.00
Calco S. A.	lb.	.85 /	.88
Carbonex S	lb.	.0475/	.05
Clays			
Aiken	ton	14.00	
Aluminum Flake	ton	20.00 /	60.00
#5	ton	23.50 /	26.50
#10	ton	20.00 /	22.50
Buca	ton	40.00	
Burgess Iceberg	ton	50.00	
Pigment No. 20	ton	35.00	
30	ton	37.00	
Catalpo	ton	30.00	
Crown	ton	14.00 /	33.00
Dixie	ton	14.00	
Hydratex R	ton	28.00	
L. G. B.	ton	17.00	
Paragon (R)	ton	13.50 /	31.50
Pigment No. 33	ton	30.00	
Suprex	ton	14.00 /	32.00
Witco No. 1	ton	14.00 /	30.00
No. 2	ton	13.50 /	30.00
Clearcarb	lb.	.1175/	.1225
Cumar EX	lb.	.0525	
MH	lb.	.065 /	.1175
V	lb.	.0975/	.1275
Darex Copolymers	lb.	$0.38 /	$0.44
Fortex	lb.	.125 /	.145
G Resin	lb.	.08	
Good-rite Resin 50	lb.	.41 /	.44
Hi-Sil	lb.	.10 /	.115
C	lb.	.11 /	.125
Kralac A	lb.	.43 /	.54
Marbon resins	lb.	.41 /	.48
Multiflex MM	ton	110.00 /	125.00
Neville R. Resins	lb.	.10 /	.155
Para Resins 2457, 2718	lb.	.04 /	.45
Pico Resins	lb.	.13 /	.185
Piccolyte Resins	lb.	.185 /	.25
Piccoumaron Resins	lb.	.07 /	.185
Piccovars	lb.	.145 /	.20
Pliolite S-3, -6, -6B	lb.	.42 /	.49
S-6C	lb.	.52 /	.59
S-Master batches	lb.	.44 /	.75
PS-60 Resin	lb.	.35	
Purecal U	ton	120.00 /	135.00
Resin C Pitch	lb.	.0225/	.031
Resinex	lb.	.0325/	.0375
Rubber Resin LM-4	lb.	.28 /	.35
S-Polymers	lb.	.44	
Silene EF	ton	120.00 /	140.00
Silvacons	ton	55.00 /	85.00
Super Multifex	ton	160.00 /	175.00
Witcarb R	ton	105.00 /	120.00
R-12	ton	45.00 /	66.00
Zeolux 20	ton	120.00 /	140.00
Zinc oxide, commercial†	lb.	.14 /	.1725

Retarders

Cumar RH	lb.	.105	
Delac J	lb.	.55 /	.60
E-S-E-N	lb.	.35 /	.37
Good-rite Vultrol	lb.	.58 /	.60
R-17 Resin	lb.	.1075/	.36
Retarder ASA	lb.	.57	
PD	lb.	.35 /	.37
TCM	lb.	.65	
W	lb.	.445	
Retardex	lb.	.47 /	.50
RM	lb.	1.25	
Thionex	lb.	1.25	

Solvents

2-50-W Hi-Flash Solvent	gal.	0.41	
3-BX Naphtha	gal.	.37	
Bondogen	lb.	.55 /	.60
Cosols	gal.	.37 /	.48
Dichloro Pentanes	lb.	.04 /	.07
Dipentene DD	gal.	.445 /	.68
GVL	lb.	1.00	
LX-572 Oil	gal.	.27 /	.32
-748 Solvent	gal.	.16 /	.23
Nevsol H	gal.	.19 /	.29
HF, T	gal.	.24 /	.34
Penetrell	gal.	.445 /	.68
Picco Hi-Solv Solvents	gal.	.17 /	.24
Pine Oil DD	gal.	.755 /	.955
PT 150 Pine Solvent	gal.	.44	
Skellysolve-E	gal.	.153	
-H	gal.	.133	
-R, -V	gal.	.109	
-S	gal.	.099	

Synthetic Resins

Geon Latices (dry wt.)	lb.	.43 /	.57
Paste Resins	lb.	.38 /	.59
Plastics	lb.	.42 /	.77
Polyblend	lb.	.475 /	.575
Polyvinyl resins	lb.	.38 /	.70
Kenflex A, L	lb.	.26 /	.27
B	lb.	.23 /	.24
N	lb.	.18 /	.19
Marvinol VR-10, -20	lb.	.36 /	.52

Synthetic Rubber and Latices

Butaprene Latex (dry wt.)			
NL types	lb.	.47 /	.52
NXM types	lb.	.55 /	.60
Butaprene NAA	lb.	.54 /	.55
NF	lb.	.49 /	.50
NL	lb.	.50 /	.51
NXM	lb.	.58 /	.59
Chemigum 30N4NS, 50N4NS	lb.	.50 /	.57
N1NS	lb.	.64 /	.71
N3NS	lb.	.58 /	.65
Latex (dry wt.)			
101-A, -AX, -E	lb.	.32 /	.41
200	lb.	.425 /	.525
235-A, -B	lb.	.50 /	.60
245-A, -B	lb.	.425 /	.525
Hycar OR-15, -15EP	lb.	.58 /	.59
-15 Powdered	lb.	.621 /	.63
-25, -25 EP	lb.	.50 /	.51
-25 NS	lb.	.51 /	.52
-25 ST	lb.	.61 /	.62
OS-10	lb.	.55 /	.56
Hycar Latex (dry wt.)			
OR-15 types	lb.	.55 /	.60
-25 types	lb.	.47 /	.52
Neoprene Latex (dry wt.)			
Type 571, 842-A	lb.	.35 /	.46
572, 700	lb.	.36 /	.47
601-A	lb.	.38 /	.49
735	lb.	.36 /	.47
Neoprene Type AC, CG	lb.	.50 /	.53
GN, GN-A, S	lb.	.38 /	.41
GRT, W, W-P	lb.	.40 /	.43
KNR	lb.	.75 /	.78
Q	lb.	1.00 /	1.03
WRT, WRT-P	lb.	.45 /	.48
Paracril 18-80	lb.	.60 /	.61
AJ	lb.	.485 /	.495

CLASSIFIED ADVERTISEMENTS

(Continued)

MACHINERY AND SUPPLIES FOR SALE (Continued)

FOR SALE: RUBBER HEEL AND SOLE MOLDS. ADLER BROS. LACE CORP., 75 Beekman St., New York 38, N. Y.

FOR SALE: PUSEY & JONES HARDNESS PLASTOMETER, NO. 450. QUABAUG RUBBER COMPANY, North Brookfield, Mass.

TANKS FOR SALE: TANK CAR SHELLS, FIVE (5) 8,000-GALlon capacity—two (2) 7,000-gallon, riveted, with coils, good condition, used for vegetable oil storage, price $500.00 each F.O.B. our plant. Contact H. P. Demerjian, Baker Castor Oil Co., 40 Ave. "A," Bayonne, N. J.

HYDRAULIC PUMPS

2—Worth. hydraulic vert. triplex pumps, type N.Q. fig. 1845, ser. nos. 1094902, 1234510, size 1¾ x 6, 23.4 GPM, water liquid; disch. pres. 2300# PSIA, 125 RPM, disch. 1½", suction 2", mounted on steel base for motr. drive, requires 40 HP motr, but no motr, new 1944, in splendid cond. Price on request.

DALTON SUPPLY CO.

2829 Cedar Street — Philadelphia 34, Pa.

GOOD USED MACHINERY

"Our 36th Year"

1—6" x 12" Laboratory Mill, m.d.
2—Ball & Jewell #2 Rotary Cutters; 1—#1; 1, with 3 h.p. motor.
1—Farrel Birmingham 6" x 13" self-contained 3-roll Calender, m.d.
4—#28 Devine Vac. Shelf Dryers, 19-59" x 78" shelves, complete.
1—16" x 42" Rubber Mill, m.d.
4—Bolling 18" x 18", 5-opening Hydraulic Presses, 10" dia. ram.
1—6' x 24' Vulcanizer quick opening door.
1—Royle #4, 6" Extruder; 1—#1, with chrome plated screw, m.d.
1—Patterson S/S 110 gal. Vacuum Mixer, Sigma Blades.
1—B.P. 20 gal. Jacketed Mixer, Double Sigma Blades.

Also other sizes Hydraulic Presses, Tubers, Banbury Mixers, Mills, Vulcanizers, Calenders, Pellet Presses, Cutters.

PHONE—WIRE—WRITE • *Send us your inquiries*

Consolidated Products Company, Inc.

13-16 Park Row, New York 38, N. Y. BArclay 7-0600

Cable Address: Equipment N.Y.

We Buy your Idle Equipment. Single items or complete plants.

RUBBER MACHINERY

Buys of the month . . . . .

MILLS
24 x 84"
22 x 60"
22 x 48" (Heavy Duty)
22 x 36" (Heavy Duty Farrel Crackers)
18 x 45"
16 x 40" (several)
18 x 30" (several)
16 x 30"
16 x 24"
10 x 24"
6 x 12" (Used Lab)
6 x 12" (New Lab)

CALENDERS
24 x 66" three-roll
20 x 62" four-roll
18 x 54" three-roll
18 x 48" three-roll
16 x 40" three-roll
10 x 20" three-roll
6 x 12" three-roll (New Lab)

HYDRAULIC PRESSES
30 x 54" with 30" ram
30 x 30" with 14" ram, 2 openings
24 x 30" with 15" ram, 2 openings
24 x 24" with 18" ram
24 x 24" with 12" ram
20 x 20" with 10" ram
Various small lab type presses.

WE ALSO FURNISH NEW "ARMACO" PRESSES OF THE FOLLOWING SIZES
12 x 12" 18 x 18" 24 x 24"
32 x 32" 36 x 36" 42 x 42"
48 x 48"
Also larger sizes, all presses having large diameter rams

BANBURY MIXERS
Sizes No. 1, 9, (3 available), 11, (2 available)
(Complete Banbury rebuilding service available)

EXTRUDERS
1", 2", 3¼", 4½", 6", 8", 12"—
All with motors and drives.

* * SPECIAL * *

We have available ten 18 x 45" mills which we are offering at an attractive price for a limited time.

We are continually buying idle and surplus equipment. Submit a list of such equipment to us and we will make immediate arrangements to convert it to cash for you.

AKRON RUBBER MACHINERY CO.

200 South Forge St., Akron 9, Ohio

Post Office Box 88 — HEmlock 9141

RUBBER HARDNESS

THE LANGUAGE OF THE RUBBER INDUSTRY SINCE 1915

DUROMETER

VARIOUS MODELS FOR TESTING THE ENTIRE RANGE

TECHNICAL DATA ON REQUEST

THE SHORE INSTRUMENT & MFG. CO., INC.

90-35 VAN WYCK EXPRESSWAY
JAMAICA 2, N. Y.

NEW and REBUILT MACHINERY

Since 1891

L. ALBERT & SON

Trenton, N. J., Akron, Ohio, Chicago, Ill., Los Angeles, Calif.

GUARANTEED REBUILT MACHINERY

IMMEDIATE DELIVERIES FROM STOCK

MILLS, CALENDERS, TUBERS — HYD. PRESSES, PUMPS, MIXERS
VULCANIZERS, ACCUMULATORS — CUTTING MACHINES, PULVERIZERS

UNITED RUBBER MACHINERY EXCHANGE

183-189 ORATON ST. — CABLE "URME" — NEWARK 4, N. J.

(Classified Advertisements Continued on Page 415)

Paracril			
B, BJ	lb.	$0.50	$0.51
BV	lb.	.51	.52
C	lb.	.58	.59
CS, CV	lb.	.59	.60
Paraplex X-100	lb.	1.00	
Silastic	lb.	2.35	4.05
Thiokol LP-2, -3	lb.	.96	
-8	lb.	1.25	
PR-1	lb.	1.95	
Type A	lb.	.47	
FA	lb.	.64	
ST	lb.	1.00	
Thiokol Latex (dry wt.)			
Type MF	lb.	.85	
MX	lb.	.70	
WD-2	lb.	.92	
-6	lb.	.70	

Tackifiers

Bunarex resins	lb.	.065	.1225
Chlorowax 70	lb.	.18	.19
Contogums	lb.	.0875	.11
Galex W-100	lb.	.155	.1925
W-100D	lb.	.1525	.19
Indopol H-100	gal.	.85	1.00
H-300	gal.	1.00	1.16
Natac	lb.	.12	.13
Nevindene	lb.	.15	.18
Picco Resins	lb.	.13	.185
Piccolastic Resins	lb.	.1855	.34
Piccolyte Resins	lb.	.185	.25
Piccopale Resins	lb.	.12	.135
Piccoumaron resins	lb.	.07	.185
Synthetic 100	lb.	.41	
Synthol	lb.	.2475	
Vistac #1	lb.	1.00	1.16
A	lb.	.215	.2725
P	lb.	.18	.235

Vulcanizing Agents

Dibenzo G-M-F	lb.	$2.585	
G-M-F #113	lb.	.88	
G-M-F	lb.	2.585	
#117	lb.	.88	
Ko-Blend I. S.	lb.	.385	
Litharge, commercial	lb.	.1425	$0.1585
Eagle, sublimed	lb.	.1575	.1585
National Lead	lb.	.1475	.1485
Magnesium oxide	lb.	.31	
Red lead, commercial	lb.	.1525	.1675
Eagle	lb.	.1675	
National Lead	lb.	.1575	.16
Sulfasan R	lb.	1.50	
Sulfur flour, comml	100 lbs.	2.05	2.20
Calco	100 lbs.	2.15	7.50
Crystex	lb.	.195	
Insoluble 60	lb.	.125	.13
Rubbermakers	100 lbs.	2.25	3.80
Stauffer	lb.	.0215	.0335
Telloy	lb.	2.50	
Vandex	lb.	3.50	
Vultax No. 2	lb.	.47	.6025
3	lb.	.51	.655
White lead silicate	lb.	.1475	.18
Eagle	lb.	.1625	.18
National Lead	lb.	.1475	.1575

Trade Opportunities

(Continued from page 386)

Norland Deutsche Schneekettenfabrik, 397 Koelnstrasse, Bonn, Germany: steel and rubber non-skid chains.

Fritz Friedmann, representing Metzeler-Gummiwerke A.G., 131/33 Westendstrasse, Munich, Bavaria, Germany: mechanical and surgical rubber goods and air foam mattresses.

Laboratoires Fisch & Cie., 130 Rue de la Mer Rouge, Mulhouse-Dornach (Ht-Rhin), France: adhesive plaster bandages for plaster casts.

Gumminwarenfabrik Carl Plaat, 312 Niehlerstrasse, Koeln-Nippes, Germany: rubber goods for the beach and the nursery and miscellaneous items as raincapes, aprons, and rubber sponges.

Trade Lists Available

The Commercial Intelligence Division recently published the following trade lists, of which mimeographed copies may be obtained by firms domiciled in the United States from this Division and from Department of Commerce Field Offices. The price is $1 a list for each country.

Aircraft & Aeronautical Supply & Equipment Importers & Dealers: Finland; Greece; Japan; Philippines.

Boot & Shoe Importers & Dealers: Philippines.

Chemical Importers & Dealers: Bolivia.

Electrical Supply & Equipment Importers & Dealers: British Honduras; Chile; Colombia; Haiti; Lebanon.

Office Supply & Equipment Importers & Dealers: Colombia.

Sporting Goods, Toy & Game Importers: Pakistan.

U. S. Imports, Exports and Reexports of Crude and Manufactured Rubber

Imports for Consumption of Crude and Manufactured Rubber

	January, 1953 Quantity	January, 1953 Value
UNMANUFACTURED, LBS.		
Crude rubber	128,837,584	$31,296,490
Latex	14,000,806	4,168,234
Jelutong or Pontianak	173,097	155,276
Gutta percha	14,200	10,474
Crude chicle	896,700	672,168
Synthetic rubber	3,396,139	905,700
Reclaimed rubber	1,061,600	59,258
Scrap rubber	2,043,114	95,431
TOTALS	150,423,240	$37,363,031
MANUFACTURED		
Rubber tires		
Auto, etc. ... no.	4,411	$262,489
Bicycles ... no.	1,376	1,052
Other ... no.	90	2,368
Inner tubes		
Auto, etc. ... no.	330	704
Footwear		
Boots ... prs.	6,337	17,795
Shoes and overshoes ... prs.	12,486	13,240
Rubber-soled canvas shoes ... prs.	840	861
Athletic balls		
Golf ... no.	14,160	4,112
Tennis ... no.	1,500	2,114
Other ... no.	91,081	11,927
Toys	......	46,562
Hard rubber goods		
Combs ... no.	16,548	1,650
Drug sundries	......	122
Other	......	6,041
Rubberized printing blankets ... lbs.	2,233	4,408
Rubber and cotton packing ... lbs.	2,000	2,934
Gaskets and valve packing	......	1,271
Molded insulators	......	305
Belting ... lbs.	8,420	12,453
Hose and tubing	......	4,545
Gloves ... prs.	36,586	14,243
Nipples and pacifiers ... gr.	3,779	5,179
Instruments ... doz.	1,531	3,949
Heels and Soles ... lbs.	5	11
Bands ... lbs.	1,525	1,453
Other	......	837
Gutta percha manufactures ... lbs.	76	24
Synthetic rubber products	......	20,933
Other soft rubber goods	......	183,338
TOTALS		$626,920
GRAND TOTALS, ALL RUBBER IMPORTS		$37,989,951

Exports of Domestic Merchandise

	January, 1953 Quantity	January, 1953 Value
UNMANUFACTURED, LBS.		
Chicle and chewing gum bases	376,966	$169,721
Balata, gutta percha, etc.	2,648	6,837
Synthetic rubbers		
GR-S type	656,218	173,475
Butyl	96,522	23,213
Neoprene	2,152,056	887,741
Nitrile type	370,253	193,022
Other	55,906	41,248
Reclaimed rubber	1,939,390	173,652
Scrap rubber	2,430,152	62,177
TOTALS	8,080,111	$1,731,086
MANUFACTURED		
Rubber cement ... gals.	82,739	$157,745
And rubberized fabric ... sq. yds.	188,530	186,060
Rubberized clothing	......	100,828
Footwear		
Boots and shoes ... prs.	13,431	40,333
Rubber-soled canvas shoes ... prs.	15,472	27,792
Heels ... doz. prs.	55,191	62,815
Soles, soling, toplift sheets ... lbs.	904,321	226,735
Gloves and mittens ... doz. prs.	11,417	48,401
Drug sundries	......	187,957
Toys, balls, novelties	......	38,924
Hard rubber goods		
Battery boxes ... no.	22,426	42,665
Other electrical goods ... lbs.	126,909	96,698
Other	......	24,670
Rubber tires and casings		
Truck and bus ... no.	49,530	2,332,713
Auto and motorcycle ... no.	36,041	467,625
Aircraft ... no.	1,973	121,919
Off-the-road ... no.	10,176	1,255,593
Farm tractor ... no.	2,987	114,818
Implement ... no.	4,569	37,107
Other ... no.	8,900	34,711
Inner tubes		
Auto ... no.	14,979	36,036
Truck and bus ... no.	30,792	149,623
Aircraft ... no.	1,110	7,336
Other ... no.	41,548	60,416
Solid tires		
Truck and industrial ... no.	5,647	69,232
Tire repair material		
Camelback ... lbs.	988,209	294,565
Other ... lbs.	301,800	231,631
Tape, except medical and friction ... lbs.	30,591	25,978
Tiling and flooring ... lbs.	164,307	44,968
Mats and matting ... lbs.	320,257	96,776
Belting		
V-type ... lbs.	78,032	109,897
Transmission		
V-type ... lbs.	122,885	239,781
Flat belts ... lbs.	54,770	83,909
Conveyor and elevator ... lbs.	219,869	212,861
Other ... lbs.	8,046	18,170
Hose		
Molded and braided ... lbs.	245,366	204,545
Wrapped and hand built ... lbs.	181,698	193,714
Other hose and tubing ... lbs.	88,537	102,953
Packing		
Sheet type ... lbs.	52,202	32,411
Other ... lbs.	126,221	169,325
Thread		
Bare ... lbs.	14,809	32,014
Textile covered ... lbs.	16,192	50,021
Compounded rubber for further manufacture ... lbs.	1,155,730	311,079
Other rubber manufactures	......	649,411
TOTALS	......	$9,032,761
GRAND TOTALS, ALL RUBBER EXPORTS	......	$10,763,847

Reexports of Foreign Merchandise

	January, 1953 Quantity	January, 1953 Value
UNMANUFACTURED, LBS.		
Crude rubber	1,182,276	$375,052
Synthetic rubber		
GR-S type	12,227	4,402
TOTALS	1,194,503	$379,454
MANUFACTURED		
Rubber toys, balls, novelties	......	$575
Drug sundries	......	548
Packing, except sheet type ... lbs.	10	109
Other natural and synthetic rubber manufactures	......	240
TOTALS	......	$1,472
GRAND TOTALS, ALL RUBBER REEXPORTS	......	$380,926

SOURCE: Bureau of the Census, United States Department of Commerce, Washington, D. C.

HAVE YOU ORDERED YOUR COPY OF "MACHINERY and Equipment for Rubber and Plastics," Volume 1? This is a Must for your personal library.

CLASSIFIED ADVERTISEMENTS

Continued

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TWO NEW MODERN HIGH PRODUCTION 3¼" RUBBER EXtruding machines built for export, but cancelled because of import license regulations. Available for immediate delivery. No drive. Address Box No. 1322, care of INDIA RUBBER WORLD.

FOR SALE: 3-ROLL CALENDER WITH 40-INCH ROLLS. ALSO eight platen hydraulic press with self-contained pumping unit. 24" x 54" platens. Address Box No. 1323, care of INDIA RUBBER WORLD.

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WANTED: RUBBER MACHINERY INCLUDING BANBURY Mixers, Heavy-Duty Mixers, Calenders, Rubber Rolls & Mixers. Extruders, Grinders & Cutters, Hydraulic Equipment, Rotary and Vacuum Shelf Dryers, Injection Molding Machines. Will consider a now-operating or shut-down plant. P. O. Box 1351, Church Street Sta., New York 8, N. Y.

WANTED: RUBBER MILLS, CALENDERS, MIXERS, BANbury Mixers, Extruders, Grinders, Cutters, Hydraulic Presses, Injection Molding Machines. CONSOLIDATED PRODUCTS CO., INC., 13-16 Park Row, New York 38, N. Y. BArclay 7-0600.

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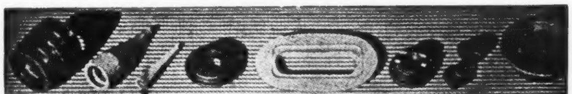

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FOR SALE

1—Banbury #1 Mixer with 50 HP Motor.
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1—Thropp 2-roll Rubber Mill 10"x24".
2—Thropp 2-roll Rubber Mills, 18"x50".
1—Thropp 2-roll Rubber Mill 14" x 30".
1—Adamson Vulcanizer, 2' x 12' with quick opening door.
1—Ball & Jewell Stainless Steel #0 Rotary Cutter with Motor.
1—Paul O. Abbe #2 Master Rotary Cutter with Ball Bearings.
1—Welding Engr. Stainless Steel #2 Extruder.
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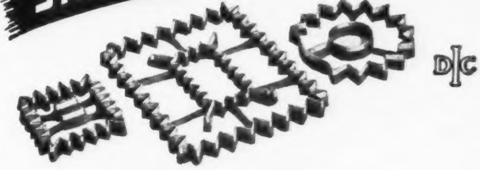

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LaSalle & Ohio Sts. • St. Louis 4, Missouri

(*Classified Advertisements Continued on Page 416*)

Custom Mixing

RUBBER-PLASTICS

We do milling and compounding of all types—black or color—master batches

All mixing done under careful supervision and laboratory control.

Phone: Butler 9-0400

Pequanoc Rubber Co.

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CLASSIFIED ADVERTISEMENTS

Continued

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That is equipped to make molded color stocks, also black. Must have one 42" press and smaller ones. Can furnish year-round volume. Prefer plant located in Akron or Chicago district. Reply in detail.

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Surplus capacity available to customers' specifications on No. 3A Banbury Type Machine. We are manufacturers of Molded, Lathe Cut, and Extruded Soft Rubber Goods and have surplus mixing capacity.

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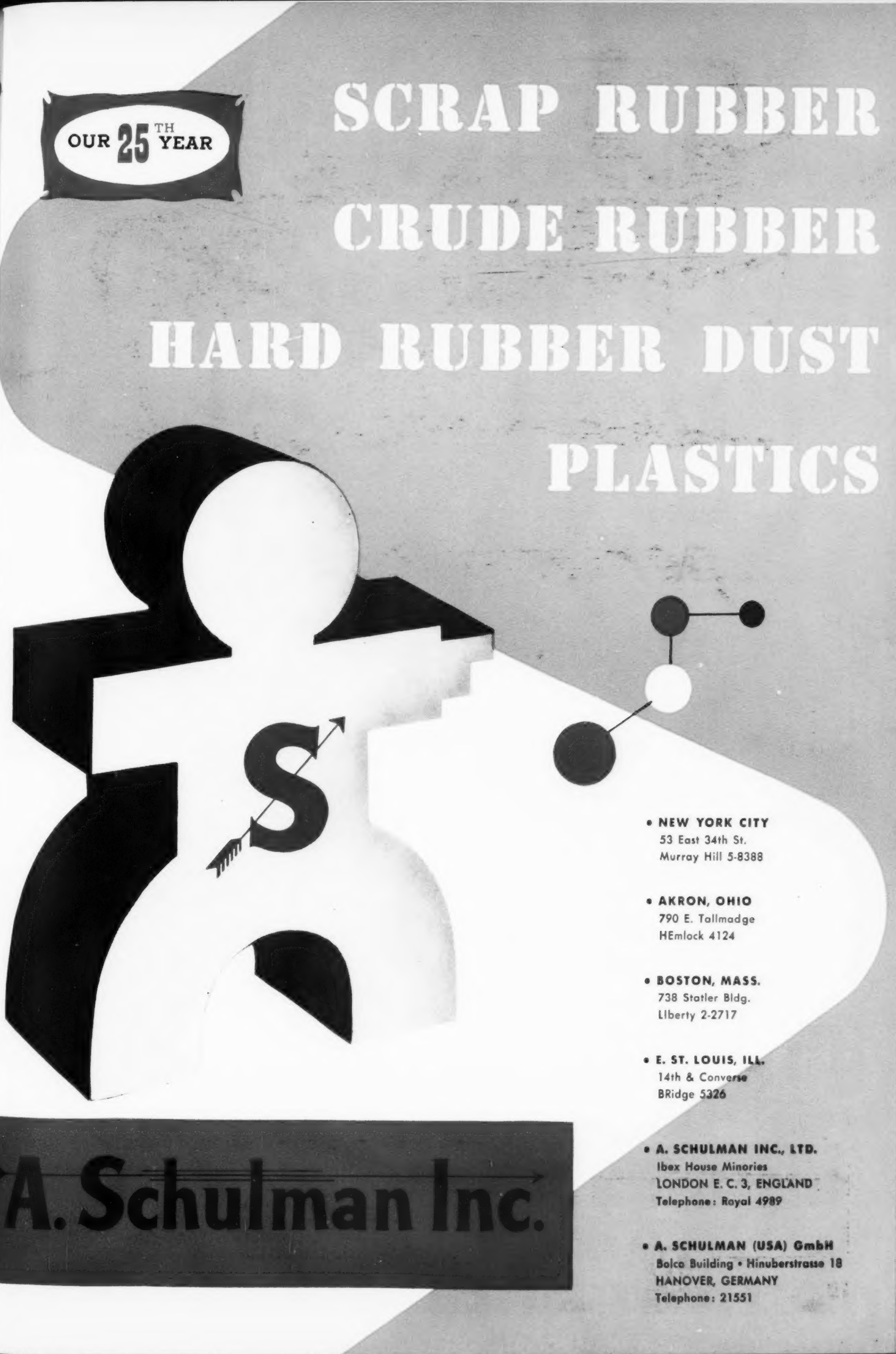
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